PowerLab 8

User's Guide

For Version 2 firmware and software

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About PowerLab 8

- Simple to operate: just connect PowerLab 8 between a power source and a pack, select a pack-specific preset and start charging, discharging, cycling or monitoring. No jumpers, plugs or dials to set! During Auto Charge, PowerLab 8 automatically determines pack capacity and sets optimal current, then dynamically adjusts charge rate as needed. Alternatively, select manual charge rates from 10mA to 40A.
- Supports both balanced (depending on chemistry) and non-balanced charging (with certain safety limitations) of the following chemistries:
  - LiPo (1s to 8s balanced, 1s to 2s unbalanced; maximum charge rate of 2.0A for unbalanced charging).
  - Li-Ion (1s to 8s balanced, 1s to 2s unbalanced; maximum charge rate of 2.0A for unbalanced charging).
  - A123©/LiFePO4 (1s to 8s balanced, 1s to 10s unbalanced; maximum charge rate of 20A for unbalanced charging).
  - LiMn (1s to 8s balanced, 1s to 2s unbalanced; maximum charge rate of 2.0A for unbalanced charging).
  - NiCd (1s to 21s; maximum charge rate of 20A).
  - NiMH (1s to 21s; maximum charge rate of 20A).
  - 6V, 12V, 24V Lead Acid (Flooded, Gel, AGM, SLA).
- Holds up to 25 user configurable presets (User Presets), optimized for the different chemistries, providing charging strategies for most common RC charging needs. Also holds up to 50 Library Presets. When using the free Charge Control Software, the number of custom presets is virtually unlimited and will grow over time to meet industry needs. Replace and customize presets to match your battery inventory.
- During balanced charging, each cell is balanced independently, providing exceptional charging safety and elevating RC packs to the safety level of cellphones. Typical packs of up to 4Ah capacity charge in 40 minutes or less using charger's 3C Auto Current Mode.
- Latest technology provides the ultimate in safety—even charges packs having hidden physical damage without danger of fire. A pack will not charge if individual cell voltages don't equal total pack voltage.
- Cell balancing to 78µV accuracy with a tolerance of 6mV and automatic overcharge protection assure longest pack life. Automatic temperature monitoring prevents pack overcharging at low ambient temperatures and charger damage at high ambient temperatures. Cold weather settings adjustable per preset.
- Selectable modes: charge only, discharge only, cycle (charge/discharge any number of times) and monitor (no charge or discharge, just measure pack voltage).
- Selectable discharge:
  - Internal discharge 10mA to 10A, 100W max.
  - Regenerative discharge 10mA to 40A, 1344W maximum when powering the PowerLab 8 from a Lead Acid battery. Regenerative discharge takes most of that energy and puts it back into the input battery. For example, when you discharge a LiPo pack for storage, you will be recharging your Lead Acid input battery.
- Multifunction backlit display lets you select presets, replace default presets from a library and shows charging data such as individual cell voltages, charge current,

supply voltage, and amount of charge (mAh) put into pack. Plus, the unique Fuel display shows percent capacity remaining in a pack.

- PowerLab 8 Charge Control Software (CCS, a free download) allows you to customize, save and load presets (including data displays), and view real-time charging data and graphs. CCS also manages firmware updates to keep PowerLab 8 operating smoothly.
- Parallel charging takes advantage of the PowerLab 8's high power output. After connecting packs using Safe Parallel Adapters, simply tell PowerLab 8 how many packs are attached—charge/discharge rates are automatically divided among the packs.
- Smart Power Management, once configured, prevents damage to your power supply or storage battery.
- Operates from any 12–24V DC power source. Inputs and outputs are protected against reverse polarity.
- Expansion Channel Mode enables multiple PowerLab 8 units to be interlocked, for highly efficient charging of multiple packs of the same chemistry. The primary PowerLab 8 controls all aspects of charging and balancing for the expansion units.

Using PowerLab 8

Quick reference

IMPORTANT: To prevent damage to the power source, you must specify the power source's voltage and current cutoffs before charging for the first time with a DC power supply, and before charging for the first time from a battery. After that, update the power source's operating characteristics any time you change to a different DC power supply or battery. You can also specify cutoffs in the CCS **Supply** tab.

This quick reference lists common PowerLab 8 tasks. What do you want to do?

To do this...	Do this...	
Select power source type*	1. Apply power. 2. Press any button. 3. At the **Power Source?** screen, use the **INC** or **DEC** button to select **Battery** or **DC Power Supply** (i.e., what is currently powering the PowerLab 8). 4. Press **ENTER** to display User Preset list.	
Navigate the menus	■ In the User Presets list: Press **INC** and **DEC** to scroll through User Presets. Press and hold **INC** or **DEC** to scroll rapidly. ■ In the User Presets list: Press **ENTER** to set up to charge with the displayed preset. ■ In menus: Press **INC** and **DEC** to scroll through options. Press and hold **INC** or **DEC** to scroll rapidly. ■ In menus: Press **ENTER** to select the displayed option and move to the next screen. ■ Press **BACK** to go back one screen. ■ Press and hold **BACK** to go directly to the User Presets list from any location. ■ Press **INC**+**DEC** (i.e., simultaneously) to access **Preset Settings**, **Charger Options**, **Manage Presets** and **Button Help** functions.	
Connect a pack	■ For balanced charging up to 3A: Attach 9-pin connector to Balance Port (may require adapter). ■ For balanced charging at any current: Attach pack discharge wires to Output jacks using banana cable, attach 9-pin connector to Balance Port (may require adapter). ■ For non-balanced charging: Attach pack discharge wires to Output jacks using banana cable.	Details

Charge, discharge, cycle or monitor a pack	1. Apply power and select power source (see above). 2. Connect pack. 3. Press **INC** or **DEC** to select desired User Preset, then press **ENTER**. 4. For each question, press **INC** or **DEC** to select correct answer, then press **ENTER**. 5. **CHECKING PACK** indicates PowerLab 8 is attempting to detect attached pack. 6. Screen displays preset's chemistry. If this matches pack's chemistry, press **ENTER** to start. (If they don't match, just wait for the next prompt, then press **ENTER** to return to the User Preset list.) 7. During the operation: ■ Press **INC** or **DEC** to view data. ■ Press **ENTER** to change charge current. ■ Press and hold **ENTER** to stop the operation. 8. "Beep beep beep" indicates the operation is complete. Display shows elapsed time. Press **INC**/**DEC** to review data. Operation is complete, but "session" remains open so you can review collected data. Press and hold **ENTER** to terminate session (this erases session data). 9. Disconnect pack. 10. Press **ENTER** to return to User Preset list.	Details
Charge packs in parallel	Only use REVOLECTRIX Safe Parallel Adapters and stackable safety banana plugs when charging/discharging/cycling packs in parallel. Connect up to 9 batteries—of same chemistry, cell count and capacity—in parallel by stacking banana plugs. Charge as above, but enter number of packs at **Parallel Packs?** question (e.g., 2P, 3P, 4P). PowerLab 8 divides current setting equally between packs.	Details

*Assumes **Choose Power Source at Startup** is enabled in the CCS.

Set Smart Power Management

IMPORTANT: To prevent damage to the power source, you must specify the power source's voltage and current cutoffs before charging for the first time with a DC power supply, and before charging for the first time from a battery. After that, update the power source's operating characteristics any time you change to a different DC power supply or battery.

You can set a variety of operating options, including the very important power source voltage and current limits. You can set Smart Power Management either at the PowerLab 8 (described below) or in the CCS Supply tab (which is easier).

Because the PowerLab 8 is capable of high power output, **it is strongly recommended that you configure Smart Power Management before you use the PowerLab 8 for the first time**, and set it again any time you significantly change the power source—either DC power supply or Lead Acid battery.

The PowerLab 8 stores two Smart Power Management profiles: one for a DC power supply and one for a Lead Acid battery. When you apply power to the PowerLab 8, the first thing you do is select the profile that matches the power source you are using. This makes it easy to change the Smart Power Management profile from a DC power supply at home to a Lead Acid battery at the field.

If you don't configure Smart Power Management to match your power source(s), these are the default settings:

- DC supply power source:
  - Voltage lower limit: 10V
  - Current upper limit: 25A
- Battery power source:
  - Voltage lower limit: 11V
  - Current upper limit: 25A
- Regenerative discharge, when enabled (it is disabled by default):
  - Regenerative voltage upper limit into Lead Acid battery: 14.40V
  - Regenerative current upper limit into Lead Acid battery: 10A

Note: All of the above parameters can be adjusted directly on the PowerLab 8, except Regenerative Amps and Regenerative Voltage, which must be set using CCS.

The following procedure sets Smart Power Management for both a DC power supply and a Lead Acid battery.

1. Connect PowerLab 8 to a 10–32V DC power supply or Lead Acid battery.
2. Press any button on PowerLab 8's panel.
3. At the **Power Source?** screen, use the **INC** or **DEC** button to select **Battery** or **DC Power Supply** (i.e., what is currently powering the PowerLab 8).
4. Press **ENTER** to display the User Preset list.

5. Press **INC**+**DEC** (i.e., press both **INC** and **DEC** at the same time) to display the Options menu (**Choose TASK?**).
6. Press **INC** or **DEC** until you see **Charger Options**, then press **ENTER**.
7. The **Charger Address?** screen should display **PRIMARY CHANNEL** (unless you are running multiple PowerLabs). If it doesn't, press **INC** or **DEC** until you see **PRIMARY CHANNEL**. Press **ENTER**.
8. At the **Power Source?** screen, press **INC** or **DEC** to select **DC Power Supply**, then press **ENTER**.
9. At the **Supply Current Limit?** screen, press **INC** or **DEC** to specify the current limit appropriate for your DC power supply, then press **ENTER**. (Cutoff current should be slightly less than the power source's maximum output current capability. To protect your power supply from damage, PowerLab 8 will never draw more current than you specify here, but charge current may not reach the preset or manually set value.)
10. At the **Low Sply Limit?** screen, press **INC** or **DEC** to specify the cutoff voltage, then press **ENTER**. (Cutoff voltage should be about 50% lower than the power supply's nominal output voltage. Example: For a 24V power supply, set the cutoff voltage to 12V. To protect your power supply, charging stops if the power supply's voltage drops below the value you set here.)
11. At the **Use Regenerative Discharge?** screen, press and hold the **BACK** button, as this feature does not apply to DC Power Supply setup. You will be returned to the User Presets list.

    You have now successfully set Smart Power Management for your DC power supply. Next, repeat the process for your Lead Acid battery.
12. Press **INC**+**DEC** (i.e., press both **INC** and **DEC** at the same time) to display the Options menu (**Choose TASK?**).
13. Press **INC** or **DEC** until you see **Charger Options**, then press **ENTER**.
14. At the **Power Source?** screen, press **INC** or **DEC** to select **Battery**, then press **ENTER**.
15. At the **Battery Current Limit?** screen, press **INC** or **DEC** to specify the current limit appropriate for your Lead Acid battery, then press **ENTER**. (Maximum output current capability of Lead Acid batteries varies widely. Generally, a standard flooded Lead Acid car battery might deliver 25A continuously and 50A for short periods. An AGM style might not have any trouble delivering 50A continuously without suffering substantially shortened life. To protect your battery from damage, PowerLab 8 will never draw more current than you specify here, but charge current may not reach the preset or manually set value.)
16. At the **Bat. Low Cutoff?** screen, press **INC** or **DEC** to specify the cutoff voltage, then press **ENTER**. (Cutoff voltage should be no lower than 11V for a 12V Lead Acid battery. Lower cutoff will provide longer PowerLab 8 operating time at the expense of Lead Acid battery life. If you are using two 12V batteries in series for 24V operation, PowerLab 8 will automatically double the cutoff voltage you set here. To protect your power supply, charging stops if the power supply's voltage drops below the value you set here.)

17. At the **Use Regenerative Discharge?** screen, press **INC** or **DEC** to enable or disable this feature, then press **ENTER**. (Regenerative discharge puts energy back into a battery power source during pack discharge cycles.)
18. Press and hold the **BACK** button to return to the User Presets list.

Smart Power Management setup is now complete. The next time you cycle power to the PowerLab 8, it will prompt you to select either DC Power Supply or Battery as the power source, but it will use the settings you entered to manage power from the selected source.

See also
CCS Supply tab

Set options

Tip: A setting is saved as soon as you change it. Also, you don't have to go through the entire sequence below—at any time, you can press and hold the **BACK** button to return to the User Presets list.

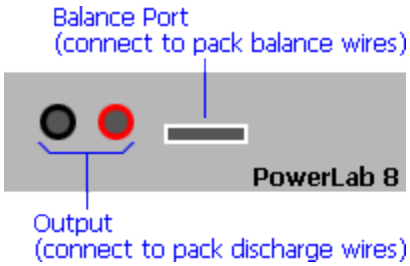
1. Connect PowerLab 8 to a 10–32V DC power supply or Lead Acid battery.
2. Press any button on PowerLab 8's panel.
3. At the **Power Source?** screen, use the **INC** or **DEC** button to select **Battery** or **DC Power Supply** (i.e., what is currently powering the PowerLab 8).
4. Press **ENTER** to display the User Preset list.
5. Press **INC**+**DEC** (i.e., press both **INC** and **DEC** at the same time) to display the Options menu (**Choose TASK?**).
6. Press **INC** or **DEC** until you see **Charger Options**, then press **ENTER**.
7. The **Charger Address?** screen should display **PRIMARY CHANNEL** (unless you are running multiple PowerLabs). If it doesn't, press **INC** or **DEC** until you see **PRIMARY CHANNEL**. Press **ENTER**.
8. At the **Power Source?** screen, press **ENTER** until you see the **Decimal Places for Cells?** screen. (See Set Smart Power Management for instructions on setting this option.)
9. At the **Decimal Places for Cells?** screen, press **INC** or **DEC** to select **2** or **3**, then press **ENTER**. (This controls how many decimal places are displayed in cell voltage data screens.)
10. At the **Quiet Charging?** screen, press **INC** or **DEC** to select **Y** or **N**, then press **ENTER**. (**Y** = no beeps during charging, **N** = beeps during charging.)
11. At the **Speaker Volume?** screen, press **INC** or **DEC** to set speaker volume, then press **ENTER**. (1 = quietest. While setting volume, speaker beeps at volume shown on screen.)
12. At the **Sound Button Clicks?** screen, press **INC** or **DEC** to select **Y** or **N**, then press **ENTER**. (Button clicks provide audible feedback when you press PowerLab 8 buttons.)
13. At the **Charge Complete Beeps?** screen, press **INC** or **DEC** to set the number, then press **ENTER**. (This controls how many times PowerLab 8 repeats "beep beep beep" when charging is complete.)
14. At the **Preset Changes Always Save?** screen, press **INC** or **DEC** to select **Y** or **N**, then press **ENTER**. (**Y** = changes made to a User Preset at PowerLab 8 are always saved to the running preset and uploaded to the Charge Control Software. Setting to **N** is not recommended, but it provides a way to temporarily override preset parameters—once you move to another preset, any changes you made will be lost and the preset will revert to its previous state.)
15. At the **Choose TASK?** screen:

- Press **INC** or **DEC** to select another setup function.
- Press **BACK** to display the User Presets list.

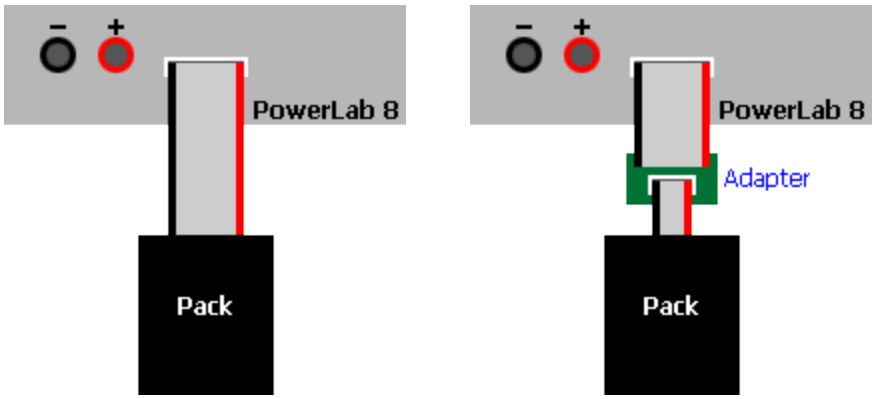
See also
CCS Options tab

Connect packs: basic

Connect the pack to PowerLab 8's Output jacks, Balance Port or both.

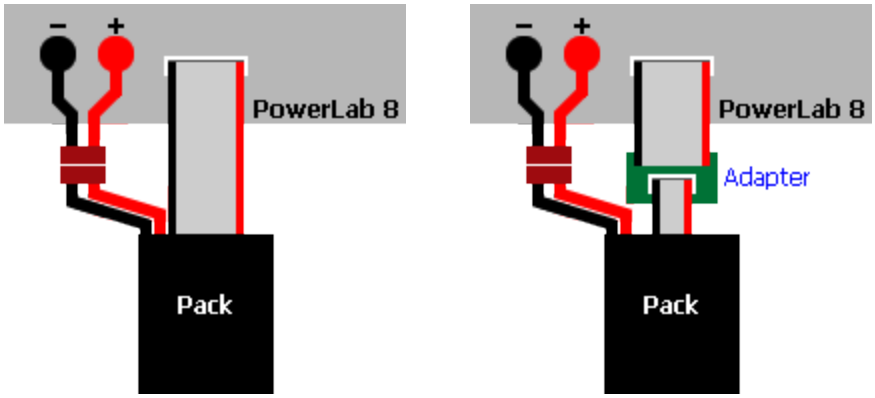


The Balance Port accepts a 9-pin Cellpro balance connector, which supports packs up to 8s. For charge/discharge rates up to 3A, you can attach just the balance connector, as shown below. If the pack has a different style balance connector, REVOLECTRIX offers a variety of adapters for most popular connector types and brands (visit the Cell-pro Adapters section in the REVOLECTRIX Web site).

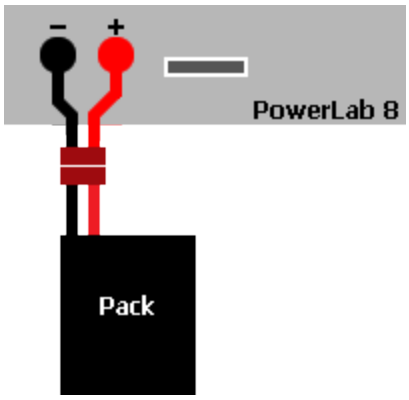


If the pack has both heavy discharge wires and a balance connector,connect both to PowerLab 8 (good for any charge/discharge current):

Note: Best practice is to connect balance connector first, then connect discharge wires.



For non-balanced charging, connect the pack to PowerLab 8 like this:



If stock REVOLECTRIX adapters don't work for your packs, you can make your own adapters using the CPBP9P-10 Cellpro battery pigtail 10", 9 position, which consists of a 9-pin connector with unterminated wires. See Balance connector pinouts in this help file, and the "CellPro Node Connector Manual" available from the Downloads page on the REVOLECTRIX Web site.

Connect packs: advanced

The table below lists several common PowerLab 8 charging configurations. Find the configuration that most closely matches how you want to charge, then click the "Details" link for more information.

Ref	Number of packs	Number of PL8s	Mode	Connect		Number of power sources	
				Balance wires	Discharge wires		
A	1	1	Normal	Yes	No	1	Details
B	1	1	Normal	Yes	Yes	1	Details
C	2 and up*	1	Normal	Yes	Yes	1	Details
D	1 (10s and up with center tap)	1	Normal	Yes	Yes	1	Details
E	2	2	Normal	Yes	Yes	1	Details
F	2	2	Normal or Expansion Channel	Yes	Yes	1	Details
G	1 (10s and up with center tap)	2	Normal or Expansion Channel	Yes	Yes	1	Details
H	1 (10s and up with center tap)	2	Normal	Yes	Yes	2, isolated	Details

*Above 9 packs in parallel, you are responsible for determining the charge/discharge current for each pack.

Configuration A

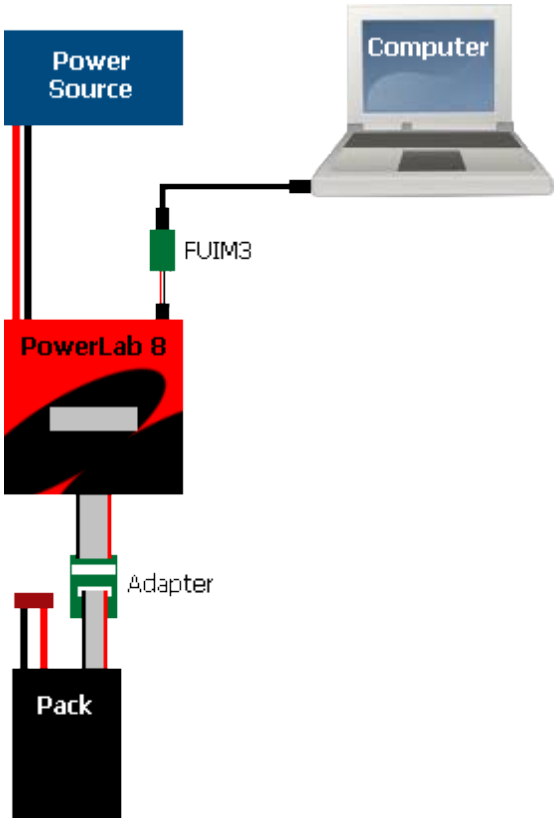
Summary: basic one-pack charging through balance wires.

Components:

- 1 PowerLab 8
- 1 power source
- 1 standard adapter (Safe Parallel Adapter does not support balance-wire-only charging)
- 1 pack
- Optional FUIM3 for computer support

PowerLab 8 mode (Normal or Expansion Channel): Normal.

PowerLab 8 maximum charge power: up to 100W charge to 1 pack (8s); balance-wire-only charging limited to 3A max.



Configuration B

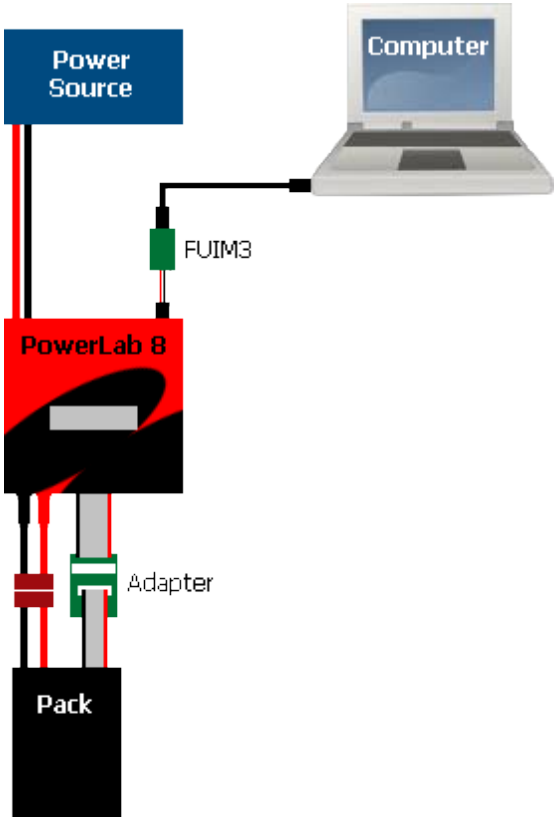
Summary: basic one-pack charging through balance and discharge wires.

Components:

- 1 PowerLab 8
- 1 power source
- 1 standard adapter or Safe Adapter
- 1 pack
- Optional FUIM3 for computer support

PowerLab 8 mode (Normal or Expansion Channel): Normal.

PowerLab 8 maximum charge power: up to 1344W charge to one pack (8s) using 24VDC/1700W power source.



Configuration C

Summary: parallel charging.

Components:

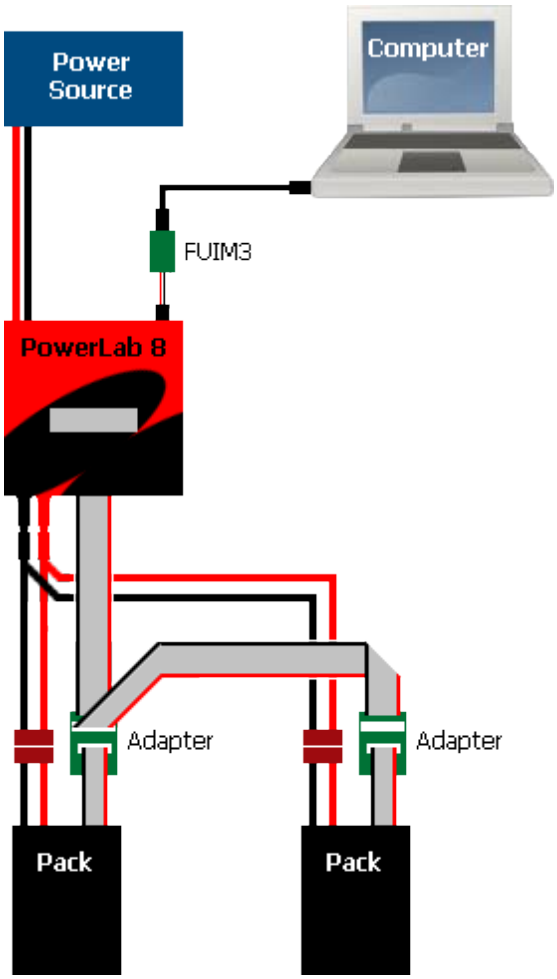
- 1 PowerLab 8
- 1 power source
- 1 Safe Parallel Adapter for each pack (do not use standard adapters)
- 2 or more packs (above 9 packs in parallel, you are responsible for determining the charge/discharge current for each pack)
- Optional FUIM3 for computer support

PowerLab 8 mode (Normal or Expansion Channel): Normal.

PowerLab 8 maximum charge power: up to 672W charge to each of two packs charged in parallel using 24VDC/1700W power source.

Constraints:

- 1 pack per adapter.
- Check pack polarity.
- Same cell count for all packs.
- Use discharge leads.



See also
Charge packs in parallel

Configuration D

Summary: parallel charging split pack (10s or larger).

Components:

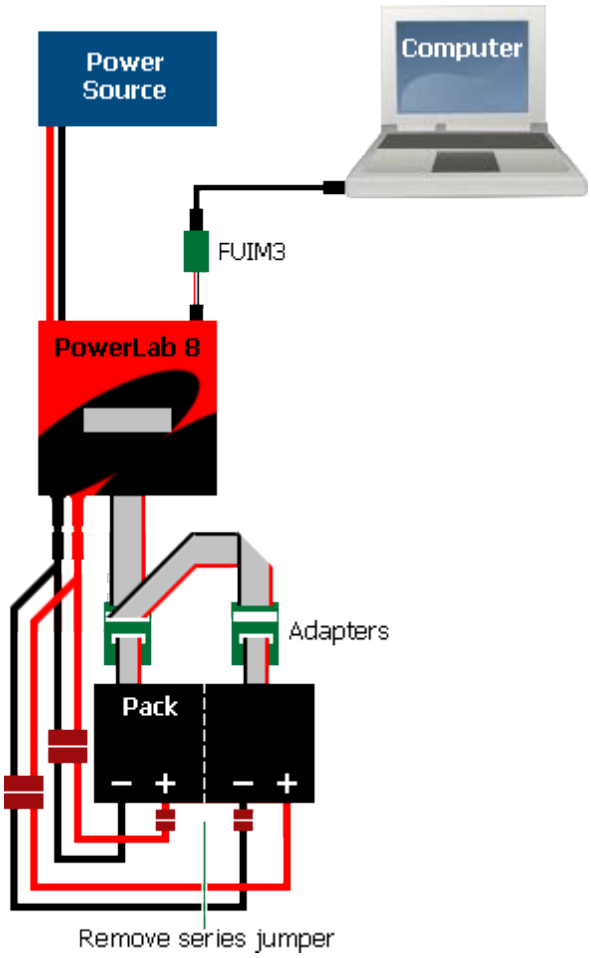
- 1 PowerLab 8
- 1 power source
- 2 Safe Parallel Adapters
- 1 10s (or larger) split pack with center tap
- Optional FUIM3 for computer support

PowerLab 8 mode (Normal or Expansion Channel): Normal.

PowerLab 8 maximum charge power: up to 672W charge to each of two packs charged in parallel using 24VDC/1700W power source.

Constraints:

- 1 pack side per adapter.
- Check pack polarity.
- Same cell count for both sides.
- Use discharge leads.


Power Source
Computer
FUIM3
PowerLab 8
Adapters
Pack
– + – +
Remove series jumper

Configuration E

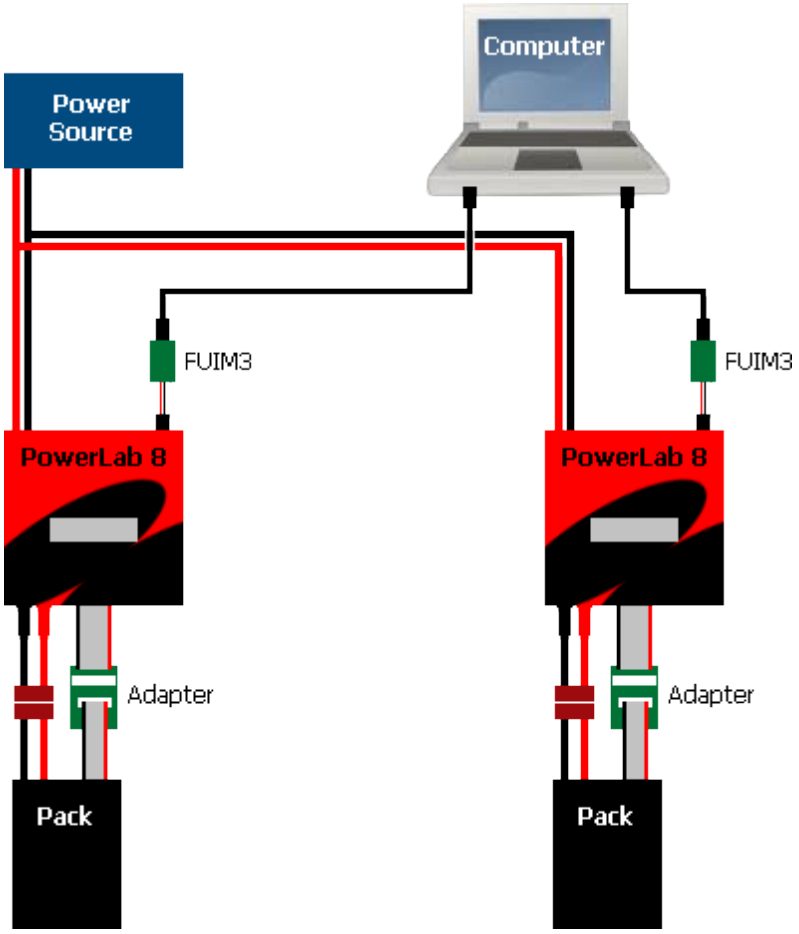
Summary: two PowerLabs charging separate packs, one power source.

Components:

- 2 PowerLabs
- 1 power source
- 2 standard adapters or Safe Parallel Adapters (1 adapter per pack)
- 2 packs (Safe Parallel Adapters require same cell count for both packs)
- 2 optional FUIM3s for computer support with 2 CCS instances

PowerLab 8 mode (Normal or Expansion Channel): Normal.

PowerLab 8 maximum charge power: up to 1344W to each pack (8s) using 24VDC/3400W power source. Standard house circuit would likely not provide enough power; would require 240VAC power supply for full power.



Configuration F

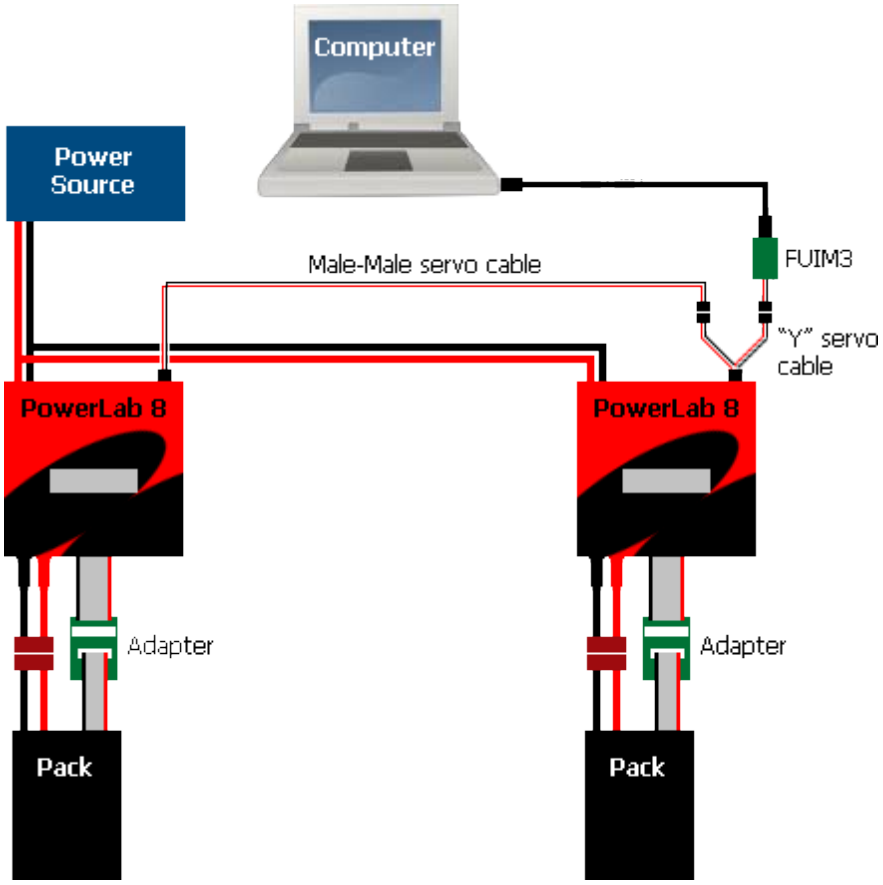
Summary: two PowerLabs charging separate packs, one power source, Expansion Channel Mode.

Components:

- 2 PowerLabs
- 1 power source
- 2 standard adapters or Safe Parallel Adapters (1 adapter per pack)
- 2 packs (Safe Parallel Adapters require same cell count for both packs)
- 1 optional FUIM3 for computer support
- 1 optional "Y" servo cable (required for Expansion Channel operation with computer support)
- Male-male servo cable (required for Expansion Channel operation; required for computer support)

PowerLab 8 mode: Expansion Channel.

PowerLab 8 maximum charge power: up to 1344W to each pack (8s) using 24VDC/3400W power source. Standard house circuit would likely not provide enough power; would require 240VAC power supply for full power.



See also
Expansion Channel Mode

Configuration G

Summary: two PowerLabs charging split pack (10s or larger), one power source, Expansion Channel Mode.

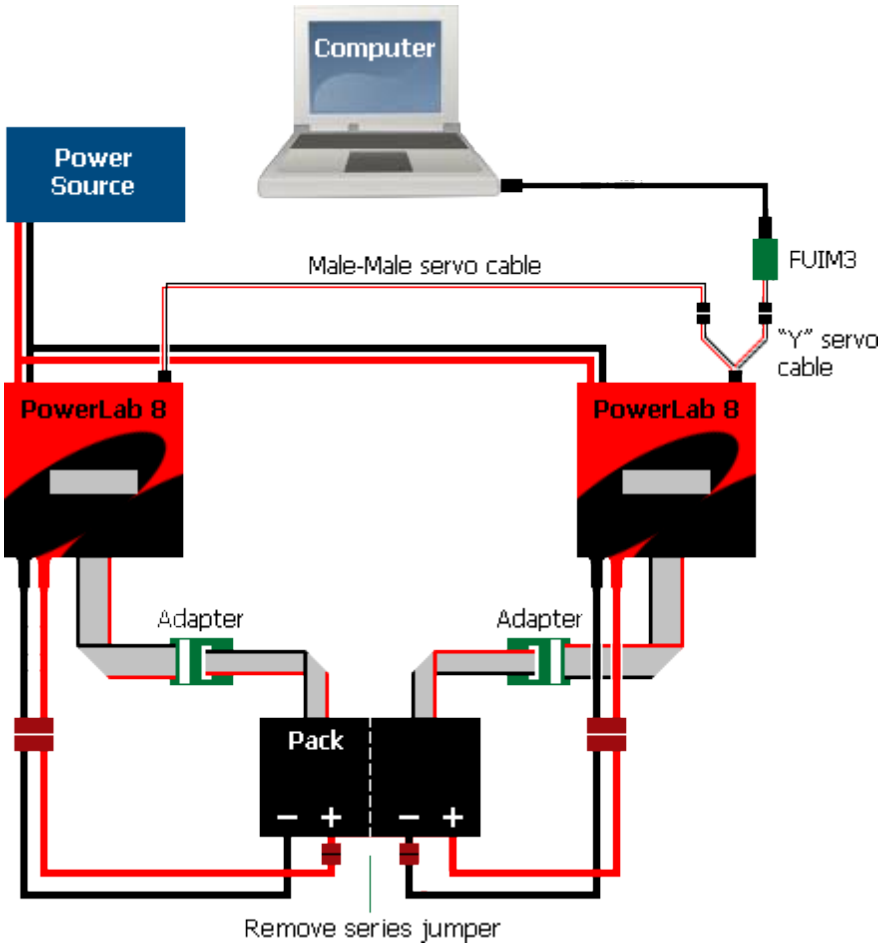
Components:

- 2 PowerLabs
- 1 power source
- 2 standard adapters or Safe Parallel Adapters (1 adapter per side)
- 1 10s (or larger) split pack with center tap
- 1 optional FUIM3 for computer support
- 1 optional "Y" servo cable (required for Expansion Channel operation with computer support)
- Male-male servo cable (required for Expansion Channel operation)

PowerLab 8 mode: Expansion Channel.

PowerLab 8 maximum charge power: up to 1344W to each pack (8s) using 24VDC/3400W power source. Standard house circuit would likely not provide enough power; would require 240VAC power supply for full power.

If not running in Expansion Channel mode, remove the male-mail servo cable and "Y" servo cable, and use 2 FUIM3s and 2 CCS instances to control the PowerLabs.



See also
Expansion Channel Mode

Configuration H

Summary: two PowerLabs charging pack (10s or larger) with center tap, two power sources, Normal mode

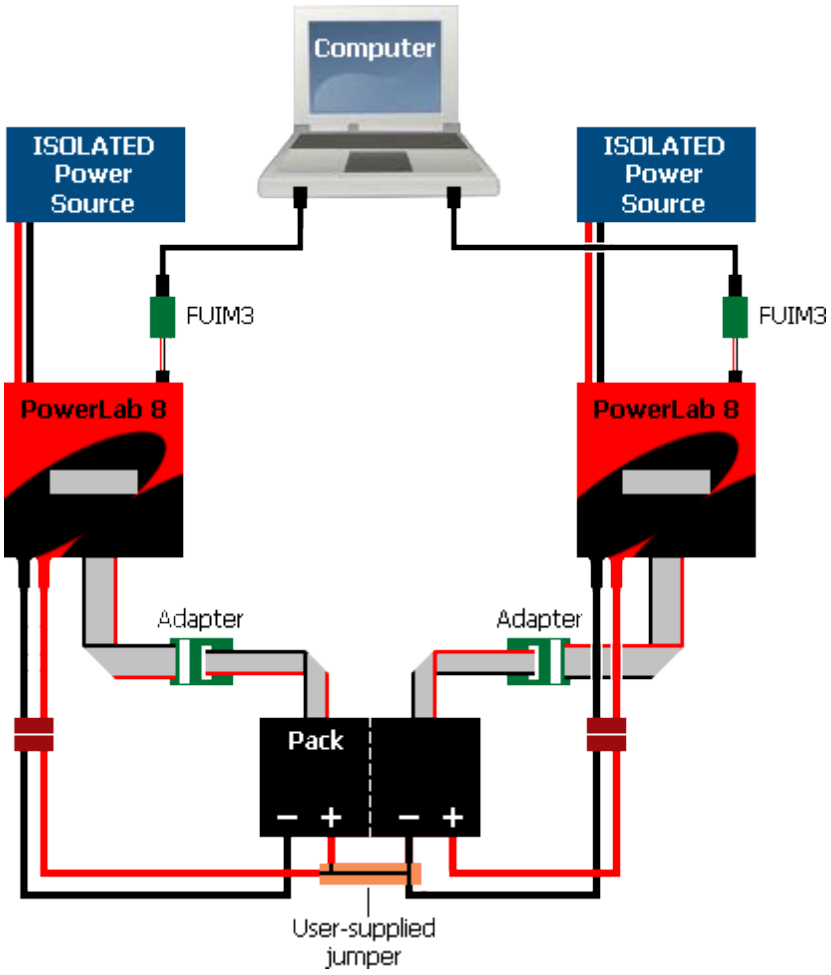
Components:

- 2 PowerLabs
- 2 **ELECTRICALLY ISOLATED** power sources: Lead Acid batteries or DC supplies (see note below)
- 2 standard adapters or Safe Parallel Adapters (1 adapter per side)
- 1 10s (or larger) pack with center tap
- User-provided jumper (see diagram)
- 2 optional FUIM3s for computer support with 2 CCS instances

PowerLab 8 mode (Normal or Expansion Channel): Normal only.

PowerLab 8 maximum charge power: up to 1344W to each pack (8s) using two 24VDC/1700W power source. Standard house circuit would likely not provide enough power to both power supplies, so each power supply should be on a separate circuit.

IMPORTANT: DC power supplies often have a common ground through their AC connections, and therefore are **not isolated**. With the power supplies plugged into outlets and turned OFF, use a continuity tester or ohmmeter to verify there is no continuity between DC ground outputs of the power supplies before connecting the PowerLabs. Failure to ensure the power supplies are electrically isolated will damage the PowerLabs as well as the pack.


Computer
ISOLATED Power Source
ISOLATED Power Source
FUIM3
FUIM3
PowerLab 8
PowerLab 8
Adapter
Adapter
Pack
– + – +
User-supplied jumper

Power supplies

PowerLab 8 is one of the highest power RC battery maintenance devices available. Running full power, it can deliver 1344W to batteries during charge. To achieve this, even on an 8 cell Li battery, it must boost the input voltage. This means the PowerLab 8 may draw up to 1600W from the input power supply.

To take advantage of PowerLab 8's full power capability, the power source should be 26.35V DC (higher voltage does not improve output power), and capable of delivering a minimum of 60A to PowerLab 8's input. Per Ohm's law, 26.35V x 60A = 1581W. However, it is generally not advisable to pull 100% of available power from a DC power supply. Therefore, if you want to attain 1344W of output power to an 8s Li battery, the power supply should be capable of 1700W or higher for best results.

Likewise, if you don't need PowerLab 8's full output power, it can operate from much lower power sources. Use the steps outlined in Set Smart Power Management to configure PowerLab 8 to never exceed the maximum capabilities of your input source(s), whether DC power supply or Lead Acid battery.

For more information about power supply selection, please download the PowerLab 8 Power Spreadsheet.

See also
CCS Supply tab

Charge/discharge/cycle/monitor a pack

Tip: These detailed instructions will help you learn how to navigate through the charging process. For brief instructions, see the Quick reference. Once you become familiar with PowerLab 8 operations, you shouldn't need instructions at all.

IMPORTANT: To prevent damage to the power source, you must specify the power source's operating characteristics before charging for the first time with a DC power supply, and before charging for the first time from a battery. After that, update the power source's operating characteristics any time you change to a different DC power supply or battery.

1. Connect PowerLab 8 to a 10–32V DC power supply or 12–24V battery.
2. Press any button to display the **Power Source?** screen. Then:
   a. Press **INC** or **DEC** to specify the power source you are using.
   b. Press **ENTER**.

   Note: If this is the first time you are using this power source, you must specify the power source's operating characteristics at this time. If you previously specified power source operating characteristics, PowerLab 8 will use those settings.

   Note: Skip this step if you disabled the **Choose Power Source at Startup** option in the CCS **Options** tab.
3. Connect the pack to PowerLab 8:
   a. If the pack has a balance connector, connect the balance connector to PowerLab 8. (See Connect packs: basic for details.)
   b. If you are charging through the pack's discharge wires (required if charge current is >3A or if the pack/battery doe not have balance wires), connect the banana jack cable between the pack/battery and the PowerLab 8.
4. In the User Preset list:
   a. Press **INC** or **DEC** to locate the User Preset you want to use. Press and hold **INC** or **DEC** to scroll rapidly.
   b. Press **ENTER,** then go to step 5.
      or
      Press and hold **ENTER**, then go to step 6 (if **Enable Quick Start** is activated in the CCS **Options** tab; you can skip most questions).

   Note: If you will be charging LiPo pack(s) at 10A or higher, select a preset with **High Power** in its title.
5. For the selected User Preset:
   a. Press **INC** or **DEC** to select the correct answer to each question, then press **ENTER**.
      - **Parallel Packs?** (select **No** if charging a single pack, **2P** to **9P** for parallel connected packs; **NOT ALLOWED** for certain chemistries).
      - **Set Charge Rate?** (select **1.0C**, **2.0C**, **3.0C** or select a current manually).
      - **Set Dsch. Rate?** (select a current).

b. At the **START?** question, select one of the following, then press **ENTER**:
   - **CHARGE ONLY** (i.e., no discharge).
   - **DISCHARGE ONLY** (i.e., no charge).
   - **MONITOR** (no charge or discharge, just monitor cell voltages).
   - **n CYCLE** (perform n charge/discharge cycles, as specified in preset).

> **Tip:** The number of cycles is specified in the preset. See Modify a preset to change the number of cycles or any other aspect of the preset.

6. At the **Use Banana Jacks?** question, press **INC** or **DEC** to indicate whether the banana jack cable is connected between the pack/battery and PowerLab 8, then press **ENTER**.

> **Note:** Skip this step if you enabled the **Suppress Use Bananas Question** in the CCS **Options** tab.

7. PowerLab 8 displays **CHECKING PACK** to see whether a pack is connected. If a pack is connected, then...
8. PowerLab 8 displays the preset's chemistry (for example, **LiPo**) and prompts you to verify it is the same as the pack's chemistry (which should also be, for example, **LiPo**). This safety check is your chance to prevent charging if the preset and pack don't match.
   - If the displayed chemistry matches the pack's chemistry, press **ENTER** to start charging. Go to step 9.
     or
   - If the displayed chemistry does not match the pack's chemistry, do nothing—the screen will time out. At the prompt, press **ENTER** to see the Preset Menu. Go to step 4.
9. During operations:
   - Press **INC** or **DEC** to view various charging data screens (the number of screens and the data displayed depends on how the User Preset is configured).

> **Tip:** You can also monitor charging data, and view data in graphs, in the Charge Control Software.

   - Press **ENTER** to override the charge and discharge current (for this session only).
   - To stop the operation:

     a. Press and hold **ENTER**. You'll see **CHARGER STOPPED**.
     b. Press **ENTER** to return to the User Presets list.

10. When the operation is complete, PowerLab 8 will "beep beep beep" several times and the display will show **ELAPSED [time] / [chemistry] DONE**. Press **INC** and **DEC** to review data screens.

> **Note:** NiMH, NiCd and Lead Acid user presets may switch to trickle charge (depending on how the preset is configured) when charging is complete.

Note: The operation is now complete, but the "session" remains open so you can review collected data. Once you press and hold **ENTER**, data collected during the operation will be discarded. If you disconnect the pack before ending the session, PowerLab 8 will display a "Pack Removed" error. This is a non-critical error, and you can ignore it in this situation.

11. Press and hold **ENTER**. Screen displays **CHARGER STOPPED**.
12. Press **ENTER** or **BACK** to return to the User Preset list.
13. Disconnect the pack from PowerLab 8.

PowerLab 8 is ready to charge another battery (step 3).

Start faster

When following the instructions above, you probably noticed that PowerLab 8 asks a lot of questions before it starts a charge, discharge, cycle or monitor. That enables you to specify exactly how PowerLab 8 will perform during these operations. Once you have a preset configured properly, two settings in the CCS **Options** tab will speed up the process:

- Activate the **Enable Quick Start** option.
  When activated, **Enable Quick Start** lets you bypass many of the questions needed to start a process. After activating this feature, press and hold **ENTER** if you don't want to select options such as discharge/cycle/monitor.
- Disable the **Choose Power Source at Startup** option (only if you consistently use the same power source).
  On startup, PowerLab 8 will always use either the DC Power Supply or Battery profile—whichever was last loaded before disabling the prompt.

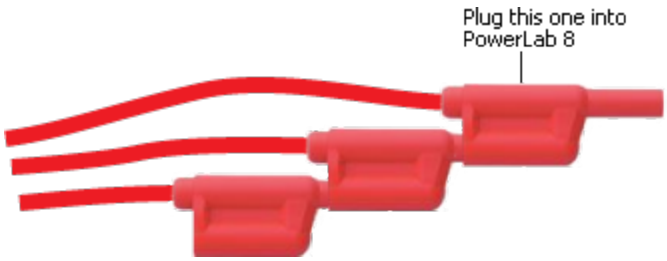
Note: You can also enable the **Suppress Use Bananas Question** option, but this is not recommended.

Charge/discharge/cycle packs in parallel

PowerLab 8 can charge, discharge or cycle up to nine LiPo or A123 packs in parallel. Parallel operations can save lots of time, but you must follow these rules:

- Always use Safe Parallel Adapters (available at the REVOLECTRIX Web site). Never use standard adapters.
- Connect only one pack per Safe Parallel Adapter. Daisy-chain multiple adapters!
- Parallel operations using Safe Parallel Adapters requires that you connect both the balance wires and discharge wires to the PowerLab 8.
- Always observe proper polarity!
- Packs must have the same cell count.
- Packs must be the same chemistry.

The best way to connect discharge wires in parallel is to stack the plugs on the safety banana cables like this:



Charging proceeds like single-pack charging, except at the **Parallel Packs?** question, use **INC** and **DEC** to specify the number of packs connected in parallel. PowerLab 8 divides charge/discharge rates equally among the packs.

See also
Connect packs: Configuration C

Expansion Channel Mode

In Normal Mode, multiple PowerLabs operate independently. Connect any number of PowerLabs to individual computer USB ports, and run multiple instances of CCS. Each PowerLab 8 communicates with a separate instance of CCS.

In Expansion Channel Mode, multiple PowerLabs are connected via each unit's PC port. Use this mode when you want to charge multiple, similar packs with reduced button presses. Expansion Channel Mode is a modular approach to maintaining similar batteries: the batteries must be the same chemistry, but the cell counts can be different.

As delivered, all PowerLabs are configured to run as a "Primary" or "Master" unit. In the OPTIONS menu, you designate one or more PowerLabs as an "Expansion" unit, e.g., Expansion Ch. 1, Expansion Ch. 2, etc. Communicating through the PC ports, the Primary unit controls the operations of all Expansion units—power source setups, options and presets. All Expansion unit keypads are disabled except for one function than enables them to be made Primary units again: **INC**+**DEC** to display the OPTIONS menu.

> **Note:** In Expansion Channel Mode, every PowerLab 8 must have a battery connected, otherwise the Primary unit will invoke an error.

To operate in Expansion Channel Mode:

- Packs must have the same chemistry, since one preset controls charging, discharging or cycling on all PowerLabs.
- Packs can have different cell counts.
- Packs can be at different levels of charge.

1. (Optional) Interlock the PowerLab 8 cases using the guides on the enclosure sides. Two screws are provided to secure adjacent cases.
2. Connect two PowerLabs using a male-male servo cable. When connecting more than two PowerLabs, or when you are connecting to a computer for CCS support, use "Y" servo cables as needed (see Configuration F and Configuration G, for example).
3. Designate one PowerLab 8 as the primary unit, and assign each of the others a unique expansion channel address. On each PowerLab 8:
   a. Press **INC**+**DEC** to display the Options menu (**Choose TASK?**).
   b. Press **INC** or **DEC** until you see **Charger Options**, then press **ENTER**.
   c. In the **Charger Address?** screen, select **PRIMARY CHANNEL** for the primary unit, or select **EXPANSION CH. n** for the other units (each unit must have a unique channel address), then press **ENTER**.
   d. As needed, set other options.
   e. Press and hold **BACK** to exit options.
4. Connect a pack to each unit.
5. On the Primary unit:
   a. Select the User Preset appropriate for the packs, then press **ENTER**.
   b. Answer all the questions and initiate charging.

c. PowerLab 8 displays **CHECKING PACK** to see whether a pack is connected at each unit. If packs are connected, then...

d. Verify that the preset chemistry matches the packs' chemistries by pressing **ENTER**.

6. During charging:

- Press **INC** or **DEC** on the Primary unit to view charging data. Data will be displayed on each PowerLab 8 for the pack connected to that unit.

> **Tip:** You can also monitor charging data, and view data in graphs, in the Charge Control Software. In the **Cells**, **Int. Res.** and **Supply** tabs, use the drop-down lists to display data from a specific unit.

- Press **ENTER** on the Primary unit to override the charge and discharge current (for all units).
- To stop charging on all units:

a. On the Primary unit, press and hold **ENTER**. You'll see **CHARGER STOPPED**.

b. Press **ENTER** to return to the User Preset list.

7. When charging is complete, each unit will "beep beep beep" several times and the display will show **ELAPSED [time] / [chemistry] DONE**. On the Primary unit, press **INC** and **DEC** to review charging data screens. Data will be displayed on each PowerLab 8 for the pack connected to that unit.

> **Note:** NiMH, NiCd and Lead Acid user presets may switch to trickle charge (depending on how the preset is configured) when charging is complete.

> **Note:** The operation is now complete, but the "session" remains open so you can review collected data. Once you press and hold **ENTER**, data collected during the operation will be discarded. If you disconnect the pack before ending the session, PowerLab 8 will display a "Pack Removed" error. This is a non-critical error, and you can ignore it in this situation.

8. After all units have completed charging, on the Primary unit press and hold **ENTER**. Screen displays **CHARGER STOPPED**.

9. On the Primary unit, press **ENTER** or **BACK** to return to the User Presets list.

10. Disconnect the packs from all units.

Regenerative discharge

Regenerative discharge routes most of the energy from the pack being discharged back into the Lead Acid battery powering the PowerLab 8. This feature is only available when the PowerLab 8 is powered from a Lead Acid battery. Regenerative discharge supports up to 40A, 1344W maximum.

Regenerative discharge

- Enable/disable regenerative discharge at the PowerLab 8 via Smart Power Management for the supply battery.
- Enable/disable regenerative discharge, and set maximum discharge current and maximum discharge voltage, in the CCS Supply tab. Remember also to set supply battery low voltage cutoff and maximum output current for charge cycles.

PowerLab 8 automatically determines whether it is connected to a Lead Acid battery or a DC power supply. If it detects a power supply, it switches to internal discharge (10mA to 10A, 100W maximum).

Modify a preset

You can change all preset properties directly on PowerLab 8. Use this procedure at any time, but it's essential when PowerLab 8 isn't connected to the Charge Control Software.

> **Tip:** You can also se the Charge Control Software's **Presets** tab to hide, show, rearrange, copy and modify presets.

1. In the User Preset list, use **INC** or **DEC** to select the preset you want to modify. Press and hold **INC** or **DEC** to scroll rapidly.
2. Press **INC**+**DEC** to access options.
3. At the **Choose TASK? > Preset Settings** screen, press **ENTER**. You now see the first of several settings for the preset.
4. In each property screen:
   - Press **INC** or **DEC** to select the desired value, then press **ENTER** to save that value and move to the next screen.
   - Press **ENTER** to move to the next setting screen without changing the property.
   - Press **BACK** to move to the previous setting screen.
   - At any time, press and hold **BACK** to return to the User Preset list. Property changes you made will be applied to the preset.
5. When you see **Choose TASK? > Preset Settings** again, you have completed a full pass through all properties for the preset.
6. Press **BACK** to return to the User Preset list.

See also
CCS Presets tab
Manage presets

Manage presets

On PowerLab 8 you can:

- Clear a User Preset.
- Copy a Library Preset for use as a User Preset.

> **Tip:** You can also use the Charge Control Software's **Presets** tab to hide, show, rearrange, copy and modify presets.

> **Note:** If the **Preset Changes Always Save?** option is set to **Y** in PowerLab 8 options, or if the **Save Preset Changes done at PowerLab** option is enabled in the CCS Options tab, and if CCS is running and communicating with PowerLab 8, cleared and copied presets are reflected in the CCS Presets tab.

Clear a User Preset

You can remove User Presets you don't need. For example, if you don't regularly charge A123 and Lead Acid batteries, you can remove those to limit the Preset Menu to the presets you do use.

1. In the User Preset list, use **INC** or **DEC** to select the preset you want to clear. Press and hold **INC** or **DEC** to scroll rapidly.
2. Press **INC**+**DEC** to access options.
3. In the **Choose TASK?** screen, press **INC** until you see **Manage Presets**, then press **ENTER**.
4. In the **Clear Current Preset?** screen, press **INC** to display **Y**, then press **ENTER**.
5. In the **Confirm CLEAR Preset?** screen, press **INC** to display **Y**, then press **ENTER**.
6. In the **Preset Cleared** screen, press and hold **BACK** to return to the User Preset list. You'll see **EMPTY PRESET** for the preset you just cleared.

> **Tip:** The CCS has better tools for managing presets (see Presets tab). Deleting a preset at the PowerLab 8, for example, leaves an empty preset location. In contrast, the CCS lets you hide presets, which can reduce the number of visible presets to a manageable level.

Copy a Library Preset

PowerLab 8 is equipped with up to 50 Library Presets. A Library Preset (which you can't change) is a starting point for creating your own User Preset (which you can change). FMA configures Library Presets with optimal charge characteristics for a variety of battery chemistries and charging strategies. You can replace an existing User Preset with a Library Preset, or—if less than 25 User Presets are installed—you can create a new User Preset from a Library Preset. After you load a Library Preset into a User Preset slot, you can change its properties.

1. In the User Preset list, use **INC** or **DEC** to select the slot where you want the new preset. Selecting an **EMPTY PRESET** is usually better unless you are intentionally overwriting an existing preset. Press and hold **INC** or **DEC** to scroll rapidly.
2. Press **INC**+**DEC** to access options.
3. In the **Choose TASK?** screen, press **INC** until you see **Manage Presets**, then press **ENTER**.
4. In the **Clear Current Preset? > N** screen, press **ENTER**.
5. In the **Copy Preset from Library?** screen, press **INC** to display **Y**, then press **ENTER**.
6. In the Library Preset list, press INC or DEC to select the Library Preset you want to copy, then press ENTER.
7. In the Confirm COPY from Library? screen, press **INC** to display **Y**, then press **ENTER**.
8. In the Library Preset has been Copied screen, press and hold **BACK** to return to the User Preset list. You'll see the new preset.
9. As needed, modify the new preset's properties.

Using the Charge Control Software

About the CCS

The free PowerLab 8 Charge Control Software (CCS) gives you unparalleled ability to customize the PowerLab 8.

This table lists common CCS tasks. What do you want to do?

To do this...	Go here...	
Download and install the Charge Control Software		Details
Monitor pack voltage, cell voltage and other data during charging	**Cells** tab	Details
Initiate and control charging from CCS	**Cells** tab	Details
View charge data in real-time graphs	**View > Graphs** command	Details
Change graph update interval	**View > Preferences > Graphing Update Rate** command	Details
View cell internal resistance during charging	**Int. Res.** tab	Details
Monitor supply voltage and current during charging	**Supply** tab	Details
Specify default power source type, and set power source operating parameters	**Supply** tab	Details
Update PowerLab 8 firmware	**Firmware** tab	Details
Update Library Presets	**Firmware** tab	Details
Restore factory User Presets	**Firmware** tab	Details
Configure, save and load PowerLab 8 options	**Options** tab	Details
Modify User Preset parameters	**Presets** tab	Details
Show, hide, reorder, save and load presets	**Presets** tab	Details
Correct preset errors	**Errors** tab	Details
Generate a custom fuel table (Fuel Wizard)	**Tools > Generate Fuel** command	Details
Run multiple CCS instances		Details

Installing the CCS

Install the Charge Control Software (CCS) from the PowerLab 8 Software Install page (in the REVOLECTRIX Web site) using one of the methods detailed there.

Once the software is installed, it will automatically check the Web site for updates every time it is started. Firmware and Library Preset updates are included in the PC software updates.

Version upgrade

As of October 2010, PowerLab 8 V2 firmware and CCS software is available at the PowerLab 8 V2 Software Install page. This version includes the following major features/capabilities:

- Expansion Channel Mode is available.
- Supports 40A maximum charge rate.
- Supports 40A maximum discharge rate (when using regenerative discharge mode).
- Supports 1344 Watts.

Installing V2 will render any V1 presets obsolete. The process of upgrading your V1 PL8 to V2 will automatically update to the latest V2 firmware version and initiate a Factory Restore. The V2 upgrade is NOT mandatory. Additionally, any V2 equipped PL8 can be downgraded to V1 by reinstalling the V1 firmware.

Cells tab

Monitor charge and discharge data in the **Cells** tab. You can also select a preset and start/stop PowerLab 8 operations in this tab.

Operating from the Cells tab

1. Connect the pack to the PowerLab 8.
2. In the **Cells** tab, open the User Preset list (near the bottom of the tab), then select the preset you want to use for charging. Selecting a preset here also selects it on the PowerLab 8.
3. To change the selected preset's settings:
   a. Click the **Edit** button. This opens the **Presets** tab and selects the preset.
   b. Change preset properties as needed.
   c. Click the **Update** button.
   d. Return to the **Cells** tab.
4. Click the **Start** button. This opens the **Start** dialog.
5. Review the settings and change them as needed.
6. Click the button for what you want to do:
   - **CHARGE ONLY** (i.e., no discharge).
   - **DISCHARGE ONLY** (i.e., no charge).
   - **MONITOR** (no charge or discharge, just monitor cell voltages).
   - **n CYCLE** (perform n charge/discharge cycles, as specified in preset).
7. In the next dialog, verify that the preset's chemistry matches the pack's chemistry. This safety check is your chance to prevent charging if the preset and pack don't match.
   - If the displayed chemistry matches the pack's chemistry, click **OK** to start charging. Go to step 5.
     or
   - If the displayed chemistry does not match the pack's chemistry, do nothing—the operation will time out. Close the dialog. In the **Cells** tab, click the **RESET** button. Start over at step 2.
8. In the next dialog:
   - Enter a name for the graph to be displayed during the operation, then click **OK**.
     or
   - If you don't want to graph the operation, click **Cancel**. (You can display a graph later if you change your mind.)
9. During charging:

- Monitor charge/discharge data in the left panel of the **Cells** tab. Elapsed time is displayed in the lower left corner. (If you are operating using Expansion Channel Mode with multiple PowerLabs, use the list in the right panel to display data from a selected unit.)

  Tip: Hover the cursor over each data line for a brief description.

- Monitor progress in graphs.
- To stop operations: Click the **STOP** button.

10. When the operation is complete, PowerLab 8 will "beep beep beep" several times.

    Note: NiMH, NiCd and Lead Acid User Presets may switch to trickle charge (depending on how the preset is configured) when charging is complete.

11. Disconnect the pack from PowerLab 8.

Helpful hints

- Fuel percentage will not be displayed during discharge.
- Fuel percentage is only accurate if you are using a preset having a fuel table that's appropriate for your pack. If you can't find a preset with a fuel table that matches your pack, you can generate one using the Fuel Table Wizard.
- Cell 1 is the cell connected to the pack's negative lead.
- Cell **Bypass** indicates the percentage of bypass applied for cell balancing: 0% = charging normally, 100% = full bypass to allow other cells to catch up.
- The **mAh IN/OUT** field shows the mAh value of the previous operation, if available. This is especially useful when cycling a pack, as you can see what the previous discharge mAh value was even when the charge mAh is increasing. Keep in mind that batteries take more energy to charge than they deliver, so the mAh IN will usually be larger than the mAh OUT.
- Once you start an operation, you cannot modify the preset. If you made an error when editing the preset, stop the operation, edit the preset, update the PowerLab 8, then restart the operation. You can queue up preset edits, but you can't update the PowerLab 8 until it is stopped.
- You can override charge or discharge currents during an operation by pressing the **ENTER** button on the PowerLab 8. This temporarily changes the current setting (the change is not saved to the preset).

See also
Charge/discharge/cycle/monitor a pack

Internal Resistance tab

The **Int. Res.** tab displays cell internal resistance when charging LiPo and A123 balanced packs. Internal resistance is not calculated or displayed during discharge cycles.

> **Note:** Internal resistance can only be measured on packs charged from below 75% of capacity. It takes 3 minutes to calculate internal resistance. Internal resistance can only be calculated during charging, and only when the pack is connected using both the balance wires and discharge wires.

If you are charging using multiple PowerLabs, use the list in the right panel to display data from a selected unit.

Viewing individual internal cell resistance enables you to more accurately evaluate pack quality and condition. If all cells show a low internal resistance, that's a good indicator that the pack can be charged and discharged at a higher C rate. Here are two examples:

- A pack rated at 5C and 40–50C discharge may have an internal cell resistance of 2 milliohms. This low resistance allows larger currents into and out of the pack without generating excessive heat.
- A pack rated at 2C charge and 20–30C discharge may have 17 to 20 milliohms internal cell resistance. The higher resistance prevents the pack from charging or discharging as quickly, and the larger resistance will generate more heat during those operations.

A cell poorly matched to the other cells in a pack will show a substantially different internal resistance. Also, a cell with high internal resistance compared to other cells may indicate the cell is weakening, which can degrade overall pack performance.

Be aware that individual cell resistance will vary during charge. This is normal and results from the different voltages and currents applied to the pack during charging.

Supply tab

Use the **Supply** tab to:

- Set the default power source type.
- Specify power source voltage and current limits.
- Monitor power source voltage, current and wattage.

DC Power Supply section

- **Enabled:** If checked, a DC power supply is the selected power source.
- **Supply Low Voltage Limit:** Set to a value just below the power supply's normal output voltage. If the supply voltage falls below this level, PowerLab 8 operations will stop. If the voltage drops fast enough, the PowerLab 8 may reboot.
- **Current Limit:** Set to match (or lower than) power supply's maximum current. If the charge rate is set higher than the input current allows, the PowerLab 8 will draw no more than the level set here, which may limit output current to the pack. Typically set this current limit to an amp or two below the power supply's specified maximum output current.

Supply Status section

- **Supply Voltage:** Real-time power source voltage and current.
- **Output:** Real-time power source power output.
- **Power Status:** displays "Normal (No Limiting)" if the power source is operating within limits set on this page. An appropriate message will be displayed if the power source limits are exceeded.

If you are charging using multiple PowerLabs, use the list in the lower right panel to display data from a selected unit.

Battery Power Source section

- **Enabled:** If checked, a battery is the selected power source.
- **Battery Type list:** Select battery type being used to power PowerLab 8. Values in this list's templates are a starting point. Change the following settings as needed.
- **Show Warning at 50% DOD:** If checked, PowerLab 8 measures battery voltage when first connected. If the battery is below 50% depth of discharge (below that point, most flooded Lead Acid batteries are damaged), PowerLab 8 beeps and issues a warning. Press the **BACK** button to cancel the operation on the PowerLab 8, then correct the situation. (You could press the **ENTER** button to proceed, but this is not recommended.)
- **Battery Low Voltage Out:** Set to low voltage cutoff value. If battery reaches this voltage, charging stops to prevent overdischarge. 11.00V is recommended for most 12V batteries. For a 24V supply battery, set to 1/2 desired cutoff voltage (PowerLab 8 detects two 12V batteries in series and doubles the **Battery Low Voltage Out** setting).

- **Battery Max Amps Out:** Set for maximum supply battery current draw. If the charge rate is set higher than the input current allows, the PowerLab 8 will draw no more than the level set here, which may limit output current to the pack. If **Battery Max Amps Out** is set too high, the battery's output voltage may drop below the **Battery Low Voltage Out** setting and charging will stop.
- **Enable Regenerative Discharge:** If checked, pack discharge energy (up to 40A/1344W) is sent to supply battery during discharge cycles. If not checked, discharge is dissipated internally (limited to 100W).
- **Regen. Amps IN to Pb:** Set to maximum regenerative current to supply battery. Consider battery chemistry and size when setting this value. For example, Lead Acid batteries should not be charged at a rate higher than C/8.

  CAUTION: An excessively high and sustained regenerative current back into the supply battery can harm the battery and reduce its useful life.

- **Regen. Charge Voltage IN to Pb:** Set to maximum regenerative voltage applied to supply battery. For a 24V supply battery, PowerLab 8 will automatically double the value set here. If the regenerative voltage reaches the value set here, PowerLab 8 switches to internal discharge to prevent the supply battery from being overcharged.

Expansion Channel section

If multiple PowerLabs are operating in Expansion Channel Mode, select the channel from which supply data will be displayed.

See also
Smart Power Management
Power supplies

Firmware tab

The **Firmware** tab enables you to:

- Determine the firmware currently installed in the PowerLab 8: it's displayed in the center of the tab. (Firmware version is also displayed in the PowerLab 8 power-on "welcome" screen.)
- Install the latest firmware version.
- Download and install the latest Library Presets.
- Restore the factory presets and options.

To update PowerLab 8's firmware:

> **Tip:** You can display similar instructions in the **Firmware** tab by clicking **Click to view instructions**.

1. Disconnect all battery packs.
2. Disconnect expansion unit(s).
3. Apply power to PowerLab 8 from a 12-24V source.
4. Set the connected PowerLab 8 as the primary unit (see step 3 in Expansion Channel Mode for details).
5. Connect the PowerLab 8 to your computer using an FUIM2 or FUIM3 interface.
6. In the CCS **Firmware** tab, click the **Update Firmware** button.

   > **Note:** Do not interrupt the firmware update!

   > **Tip:** Time remaining for the firmware update is displayed just below the **Update Firmware** button.

7. In the "Firmware Programming Complete" dialog, click the **OK** button.

To update the Library Presets:

1. Click the **Update Library** button.
2. In the confirmation dialog, click the **Yes** button.
3. You will be notified when the update is complete. In the dialog, click the **OK** button.

To restore the factory presets and options:

1. Click the **Factory Restore** button.
2. In the confirmation dialog, click the **Yes** button.
3. You will be notified when the restore is complete. In the dialog, click the **OK** button.

Full firmware and preset update process

Over time, new CCS versions and new factory default presets will be released. These changes may correct safety violations or provide enhanced capabilities that would cause older presets to contain errors when running in newer firmware or CCS software. This procedure enables you to update your custom presets as well as the firmware:

1. Back up your custom presets one at a time using the **File > Save Preset X to File** command.
2. Update the firmware (see instructions above).
3. Perform a factory restore (see instructions above).
4. Restore custom presets one at a time using the **File > Open File to Preset X** command.
5. Check the **Errors** tab to see whether any of the old presets cause an error in the new CCS/firmware. Double-click each error and correct the problem.
6. Re-save your custom presets one at a time using the **File > Save Preset X to File** command.

Options tab

In the **Options** tab you can:

- Specify how information appears in PowerLab 8's display.
- Control whether presets are uploaded to the CCS.
- Specify speaker volume and beep settings.
- Set startup options.
- Save and load option sets.

> **Note:** After changing anything in the **Options** tab, click the **Update** button to download the changes to PowerLab 8.

Visual Settings section

- **Cells Scroll Seconds:** Set time for cell data to display during charging.
- **Cell Decimals:** Set cell voltage values in hundredths or thousandths of a volt.
- **Name on Both Lines:** Set time that a long preset name appears in both lines before second line is replaced with charge specs.
- **Preset Name Scrolling:** Set time that portions of a long preset name appear in the display's top line.
- **European comma decimal:** When checked, comma is displayed as decimal point.
- **Text boxes:** Substitute your own text in the power-on "welcome" screen.

> **Tip:** Enter your name and/or phone number in the text boxes.

Preset Settings section

- **Save Preset Changes done at PowerLab:** When checked, preset changes made at PowerLab 8 are stored in the current preset and uploaded to the CCS. Disabling this option is not recommended, but provides a method for temporarily overriding a preset's parameters for the duration of one charge.

Audio Settings section

- **Speaker Volume:** Set PowerLab 8 speaker volume.
- **Charge Done Beeps:** Set the number of beeps announcing that charging is complete.
- **Button Clicks ON:** When checked, PowerLab 8 emits a beep each time a button on its front panel is pressed.
- **Quiet Charging:** When checked, does not beep at key points during charging.

Start Settings section

- **Enable Quick Start:** When checked, you can skip over a preset's setup questions—just press and hold **ENTER**—when preparing to charge a pack at the PowerLab 8.

- **Suppress Use Bananas Question:** When checked, the charge sequence does not ask whether you are charging using the banana cable.

  Note: If this option is checked, PowerLab 8 assumes you are charging using the banana cable. Attempting to charge using only balance wires will result in an error.

- **Choose Power Source at Startup:** When checked, you must always specify the power source immediately after applying power to PowerLab 8.

  Tip: If you always use the same power source, specify the power source in the Supply tab, then uncheck the **Choose Power Source at Startup** option. This will save you a step each time you power up the PowerLab 8.

Save and load options

To save a set of options on your computer: Click the **Save to File...** button. Select a directory, enter a name, then click the **Save** button.

To load a set of options from your computer:

1. Click the **Load from File...** button.
2. Locate and select the options file, then click the **Open** button.
3. Click the **Update** button to download the options to PowerLab 8.

Presets tab

The Charge Control Software gives you almost total control over User Presets, including which ones are available in PowerLab 8, the order in which they are displayed, charging characteristics and the content and order of data screens displayed during charging.

Edit a User Preset

1. If the **Advanced Properties** option is checked, uncheck it. (See "Advanced properties," below, for more information about this option.)
2. In the left panel, click the User Preset you want to edit. Parameters and screens for the preset are displayed in the right panel.
3. Then:
   - To change preset order: In the left panel, drag the preset number up or down.
   - To prevent the preset from being displayed in PowerLab 8: Open the list next to the preset and click **Hide**.
   - To change charge characteristics: Click the **Properties** tab in the right panel, then set options as needed.
   - To change charge data screens: Click the **Screens** tab in the right panel, then...
     - To change what a screen displays: Click the arrow next to the screen preview, then select the desired information in the drop-down list.
     - To show or hide a data screen: Select **Show** or **Hide** as appropriate.
     - To change screen order: Drag the screen number up or down.
4. Click the **Update** button.
   or
   If you don't want to apply the changes, click the **Cancel** button.

> **Note:** The Charge Control Software performs extensive checks to make certain you have specified permissible charge parameters. If it finds errors, it will not download presets to PowerLab 8 until the errors are corrected. Errors are displayed in the **Errors** tab. To correct an error, double-click the error in the **Errors** tab; you will be taken to the corresponding preset property, which you can change to an acceptable value.

Information about properties

To view a brief description of a property: Hover the cursor over the property label.

To view a detailed description of a property: Click the property label. The description will appear in a pop-up window.

Save, load, backup and restore User Presets

To save a User Preset:

1. In the **Presets** tab, click the User Preset you want to save. The selected preset will have a gray background.
2. **File > Save Preset X to File...** . This opens the **Save a Preset** dialog.
3. Navigate to the directory where you want to save the file.
4. (Optional) Overwrite the default preset file name (this doesn't change the preset's display name).
5. Click the **Save** button.

> **Tip:** Save your custom presets individually, as described above, to have more flexibility when loading them. Later, you may need to initiate a factory restore to obtain the latest presets from REVOLECTRIX. If that occurs, you will appreciate having backup of all your custom presets.

To load a saved preset:

1. In the **Presets** tab, click the User Preset location where you want the loaded preset to reside. The selected location will have a gray background.

> **Note:** You can load a preset file into any User Preset location. The loaded file will overwrite the preset in the selected location. You cannot load a preset file into any Library Preset location.

2. **File > Open File to Preset X...** . This opens the **Open a File to Preset X** dialog.
3. Navigate to the directory where the preset file is stored.
4. Click the preset file.
5. Click the **Open** button.
6. Modify the preset as needed.
7. Click the **Update** button to download User Presets to PowerLab 8.

To load a preset from a saved graph:

1. In the **Presets** tab, click the User Preset location where you want the loaded preset to reside. The selected location will have a gray background.
2. **File > Open Graph to Preset X...** . This opens the **Open a File to Preset X** dialog.
3. Navigate to the directory where the graph file is stored.
4. Click the graph file.
5. Click the **Open** button.

To save all User Presets in a single archive file:

1. In any tab, **File > Backup All User Presets...** . This opens the **Backup User Presets** dialog.

2. Navigate to the directory where you want to save the archive file.
3. Enter a name for the archive file.
4. Click the **Save** button.

To restore all User Presets from an archive:

> **Note:** This operation will overwrite all User Presets.

1. In any tab, **File > Restore All User Presets...** . This opens the **Restore User Presets** dialog.
2. Navigate to the directory where the archive file is stored.
3. Click the archive file.
4. Click the **Open** button.
5. Click the **Update** button to download User Presets to PowerLab 8.

> **Tip:** Use the **Backup** and **Restore** commands when you want to completely change the PowerLab 8's operations. For example, you might have one PowerLab 8 set up as your Lithium-only charger and another PowerLab 8 set up as your NiCd/NiMH-only charger. Bulk backing up is not a substitute for backing up individual custom presets. In the future, if you need to do a factory restore to get the latest presets, restoring the entire archive won't be much help. Many presets in an archive may generate errors when running in a newer firmware and/or CCS version. It's better to factory-restore all user presets, then load in your custom presets individually and correct any errors that show up (instructions for dealing with errors are provided in the Errors tab topic).

Advanced properties

Basic properties cover charge and discharge parameters needed by most users. Advanced properties encompass an extended set of parameters that may be useful to users having special requirements.

To view and set advanced properties: Activate the **Advanced Properties** option. Access advanced properties in the tabs over the right panel.

See also
Modify a preset

Errors tab

The **Errors** tab lists preset errors detected by PowerLab 8.

If there are no preset errors, the tab is labeled **No Errors**. If there are preset errors, the tab is labeled **X Errors**, where **X** is the total number of errors found in all loaded presets.

To correct a preset error: In the **Errors** tab, double-click the error description. CCS displays the corresponding location in the preset's properties list.

Errors in custom presets

When you customize a preset, CCS generally provides only valid options for various parameters. It's still possible to set conflicting values, however, so CCS checks all changes to make certain no safety rules are violated.

Over time, new CCS versions and new factory default presets will be released. These changes may correct safety violations or provide enhanced capabilities that would cause older presets to contain errors when running in newer firmware or CCS software. This procedure enables you to update your custom presets as well as the firmware:

1. Back up your custom presets one at a time using the **File > Save Preset X to File** command.
2. Update the firmware (see instructions for the Firmware tab).
3. Perform a factory restore (see instructions for the Firmware tab).
4. Restore custom presets one at a time using the **File > Open File to Preset X** command.
5. Check the **Errors** tab to see whether any of the old presets cause an error in the new CCS/firmware. Double-click each error and correct the problem.
6. Re-save your custom presets one at a time using the **File > Save Preset X to File** command.

Graphs

CCS graphics enable you to see how battery performance changes over time during charging and discharging operations.

When you start a charge, CCS opens a dialog in which you can name the graph. Enter a descriptive name, then click **OK**.

> **Note:** At this point, the graph is being recorded in your computer's memory. It is not yet saved to the hard drive.

To set graph update interval: In the main CCS window, **View > Preferences > Graphing Update Rate**.

> **Tip:** If your computer has plenty of RAM, choosing a smaller update interval is okay. For older computers, leave the update interval at the default 10 seconds.

To view graphs: In the main CCS window, **View > Graphs**. This opens the **Graph** window.

Perform the following operations in the **Graph** window.

To select the parameter displayed in the graph:

- **View > Amps vs. Time**
- **View > Cell Volts vs. Time**
- **View > Fallback vs. Time**
- **View > Fuel vs. Time**
- **View > Internal Resistance vs. Time**
- **View > Pack Capacity vs. Time**
- **View > Pack Volts vs. Time**
- **View > Cell Volts vs. Capacity**

> **Note:** Availability of some graphs depends on the chemistry of the pack being charged.

To measure values and time in a graph: Hover the cursor over the graph. Value and time are displayed in the command bar.

To customize graphs: **View > Options**.

To zoom in: Drag a rectangle around the area you want to enlarge. After that, use the commands in the **Zoom** menu.

To resize the graph window: Drag any corner or side, or click the window's Maximize button.

To annotate a graph: Enter notes in the lower left corner.

To save a graph as an image: **File > Save As**.

To print a graph: **File > Print**.

After you generate a graph, perform the following operations in the main CCS window.

To save graph data: **File > Save Graph**. (This saves all data, not just the data currently displayed in the graph.)

> **Tip:** CCS will prompt you to save the graph if you stop charging or attempt to exit the program.

To save graph data in a location of your choice: **File > Save Graph As...** .

To display previously saved data as a graph: **File > Open Graph...** . (You can view any parameters that were originally recorded.)

To clear data from the **Graph** window: **File > Close Graph**.

Exporting graph data

You can export graph data for detailed analysis in other tools, such as spreadsheets. You don't have to export graph data immediately—as long as you save a graph, you can open it later to export its data.

CCS exports data in either of two formats:

- Tab-delimited text. This format exports all data recorded by CCS, including data that was not displayed in the graph. Some of this data is purely technical and relates to PowerLab 8 operation. Other data, such as supply voltage, can provide useful insights.
- BT2 format used by the West Mountain Radio CBA graphing software. This format exports only voltage versus charge. A BT2 file can be modified with a text editor. One suggested change is to update the file name on line 6, which may not be suitable for displaying in the CBA graph.

To export graph data as a text file: **File > Export Graph > Text File...** .

To export voltage data in CBA format: **File > Export Graph > West Mountain CBA II File...** , select the data you want to export, then click the **Export** button.

Generate a custom fuel table

PowerLab 8 calculates the fuel level in a battery based on a lookup table for a particular cell manufacturer or chemistry. Even two LiPo batteries from different eras or different brands from the same era can have vastly different voltage versus time characteristics during charging. When the fuel table doesn't match the cell's chemical composition, errors in the fuel reading occur.

An accurate fuel table can be generated by cycling a cell (or pack) and recording the cell voltage. The Fuel Table Wizard automates the process. However, it will take a few hours to complete.

1. **Tools > Generate Fuel**. This opens the **Fuel Wizard**.
2. Follow setup instructions in the **Fuel Wizard**.
3. Click the **Generate Fuel** button.

About fuel tables

How do you know whether you need a custom fuel table for a battery? If you use Auto mode (AUTO 1C, 2C or 3C) for simplified charging, and your battery is anything other than a generic 15C to 20C LiPo, you probably need a custom fuel table. The clue is that the PowerLab 8 over-or under-calculates the optimum charge rate when using one of the Accurate Charge presets.

Suppose you are about to charge a 2200mAh pack, and you set the PowerLab 8 for AUTO 2C charge. If the pack is mostly discharge when you start the charge, then within 10–20 minutes the current should gradually increase to around 4A (a perfect 2C charge would be 4.4A, but the PowerLab 8 is intentionally conservative in AUTO mode, even if the fuel table precisely matches the chemistry).

If you see that the charge rate only reaches 1A or 2A, or it overshoots to 6A or higher, then you need to generate a custom fuel table to have PowerLab 8 correctly calculate AUTO rates for the pack. The alternative is to manually set the charge current to 4.4A when charging this pack. Be aware that PowerLab 8 will use available fuel table data during both AUTO and manual charge modes to estimate how much capacity remains in the pack being charged.

Another way to know when a pack needs a custom fuel table: If the pack is charged to 100%, then you fly for a short time and note that only 20% fuel is remaining.

Run multiple CCS instances

You can run multiple instances of CCS on one computer to support multiple PowerLabs. Here's how:

1. Connect the first PowerLab 8 to the computer using an FUIM3.
2. Launch CCS. **Waiting to Start** should appear at the top of the CCS window.
3. Connect the next PowerLab 8 to the computer using another FUIM3.
4. Launch CCS again (this will be the second instance). **Waiting to Start** should appear at the top of the CCS window.

Configuration D and Configuration G in the "Connect packs: advanced" section show wiring that supports multiple CCS instances.

Other information

Charging tips

General information

- Because PowerLab's cell balancing technology monitors individual cells, you don't need to cool a pack before charging it. Go from flying to charging to flying again without waiting.
- Cells in a pack have different voltages when they are discharged. PowerLab 8 balances (equalizes) cell voltages while it is charging the pack. REVOLECTRIX chargers provide the highest available balance current in the industry: up to 1A, and now customer-adjustable.
- During charging, cells that charge the fastest are the weakest cells in the pack. At the end of charging, cells with the highest voltage are weakest. This happens because weaker cells have lower capacity, and they charge faster than stronger cells.
- If PowerLab 8 displays **LOW VOLT RESTORE**, the pack was overdischarged during its last use. The charger will attempt to repair LiPo cells measuring between 0.5V and 2.7V, or A123 cells measuring 0V to 2.0V. To avoid additional damage to restored cells, do not overdischarge a repaired pack.
- By definition, end of life for a LiPo cell is when the cell can only be charged to 80% of its original capacity rating. The number of charge/discharge cycles a cell undergoes before reaching end of life depends on several factors, including cell quality, discharge rate, internal heat generated during use, and other parameters. Cells in an older pack may be more out of balance, but PowerLab 8 will still balance them to within 6mV by the end of charge. For this reason, it may take longer to balance older packs. The charger may show FUEL=99% for several hours while it is balancing a high capacity (3Ah and up) "veteran" pack that is severely out of balance, but User Presets might be set to stop balancing after a preset time. Often, the last few millivolts of balancing take a very long time and do not significantly improve overall pack charge or performance.

Charging packs

- You can top off packs, or remove them when they are partially charged. There is no way to damage a pack when using PowerLab 8. (The only exception to this is if you are using Safe Parallel Adapters and you accidentally connect two packs having different number of cells together in parallel. This is less a function of the PowerLab 8 and more about assuring proper connection of packs to the PowerLab 8.)
- If a pack is at 80% or less of its capacity when connected to an auto-detect speed controller, the controller may lower its cut-off voltage. This could overdischarge

the pack during the flight. Auto-detect speed controllers should properly set cut-off voltage if packs are charged to at least 90%.

- To save time, stop charging when the pack reaches about 95% of capacity. That last 5% takes the longest. By default, User Presets notify you with two beeps when a pack reaches 90% of capacity (that threshold can be easily adjusted using the Charge Control Software).
- Some cells may sag 0.10V within an hour after charging. This is normal as packs age.
- In REVOLECTRIX's opinion, over-discharging an A123 pack below 2.0V/cell will damage the cells (contrary to some reports). PowerLab 8 requires a minimum pack voltage of 1.5V to activate charging. If an A123 pack is below this voltage, do not try to repair the pack by boosting voltage. Even if you manage to repair the pack, it will not have many cycles left and PowerLab 8 will reject it for multiple reasons (as indicated by displayed safety codes).

Storing packs

- For best results, LiPo and A123 packs should be stored at 50% of capacity. Use PowerLab 8's **LiPo All Brands Storage Charge** preset to prepare LiPo packs for storage, and the **A123 All Cpcty Storage Charge** to prepare A123 packs for storage.

  CAUTION: Be sure the storage preset matches the battery chemistry. Using the incorrect preset will damage cells.

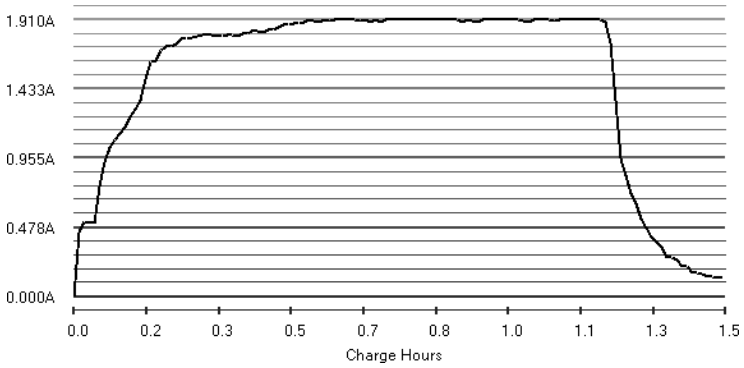
- LiPo packs charged to 100% should not be cooled below room temperature. Cells at 90% or less capacity can be cooled below 32ºF (0ºC).

How Auto Current Mode works

PowerLab 8's Auto Current Mode (indicated by the charge rate Ax.0C) precisely monitors individual cell fuel levels (cell voltages) in a LiPo, Li-Ion or A123 pack. If PowerLab 8 determines it is charging too fast, it slows down. Likewise, if it is charging too slow, it speeds up. PowerLab 8 adjusts charge current at one minute intervals throughout the charge cycle.

When charging starts, it takes a short time for PowerLab 8 to determine the correct parameters, so it may "hunt" for up to 30 minutes before it settles on the optimum current. This is normal, and doesn't harm the pack. The longer the charge, the more accurate the calculation.

The plot below shows how Auto Current Mode adjusts the charger's current when charging a 2.1Ah pack at 1.0C Auto. Initially, charge current is 500mA (this starting current is defined in the User Preset and is adjustable). Within a few minutes, PowerLab 8 increases the current, and it eventually reaches 1.0C (1.9A in this example). This is slightly under the ideal 1.0C charge rate of 2.1A for this pack. Fuel rate Auto charging is intentionally calculated to be slightly conservative. Current drops as the pack reaches full charge (the charger changes to constant voltage mode). When charge current drops to about 0.05C, the pack is fully charged. If the cells are balanced, charging terminates. Termination settings are also controlled by the User Preset parameters.



With the 1.0C Auto Current Mode, a fully discharged pack is charged to its nominal capacity in about 60 to 80 minutes, depending on the state of imbalance. Auto Current Mode takes into account a pack's starting charge level, so topping off a 50% discharged pack takes only about 30 minutes.

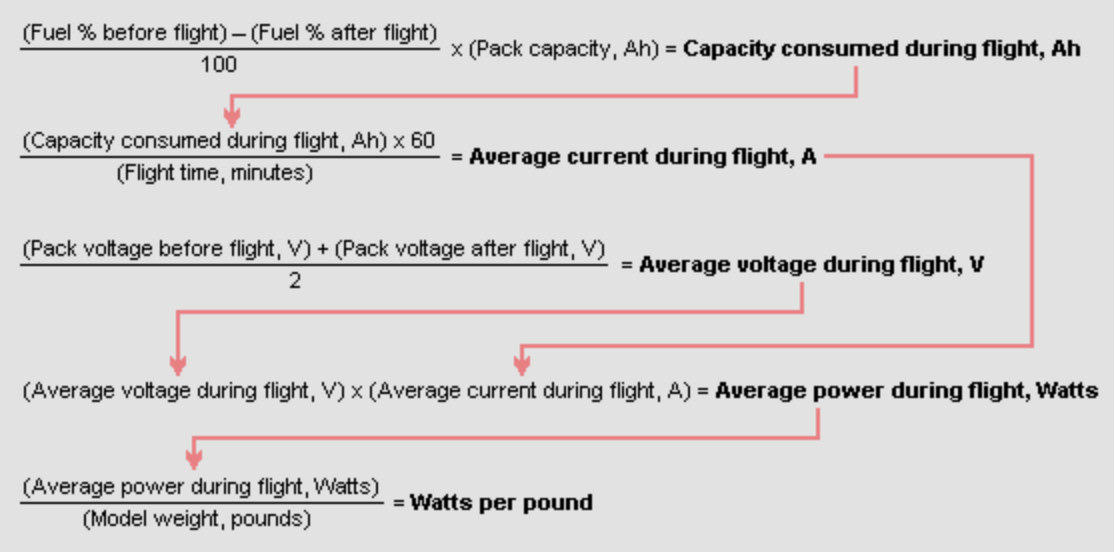
If you find that Auto Current Mode is not properly calculating the ideal charge rate for a pack, that pack probably require a custom fuel table. See Generate a custom fuel table for details.

Estimating performance factors

If you don't have a way to directly measure your propulsion system's electrical parameters, PowerLab 8 enables you to estimate them using before- and after-flight measurements.

> **Note:** The calculations outlined below work best when the pack is charged using a custom fuel table. They may be invalid if the fuel table does not match the pack under test.

1. **Collect data.**
   a. Charge pack.
   b. When charging is finished, record Fuel % and total pack voltage (i.e. sum of cell voltages).
   c. Fly plane (or test on the ground). Record flight time in minutes.
   d. Connect pack to charger. Record Fuel % and total pack voltage.
2. **Calculate performance factors.**


(Fuel % before flight) – (Fuel % after flight) / 100 x (Pack capacity, Ah) = Capacity consumed during flight, Ah
(Capacity consumed during flight, Ah) x 60 / (Flight time, minutes) = Average current during flight, A
(Pack voltage before flight, V) + (Pack voltage after flight, V) / 2 = Average voltage during flight, V
(Average voltage during flight, V) x (Average current during flight, A) = Average power during flight, Watts
(Average power during flight, Watts) / (Model weight, pounds) = Watts per pound

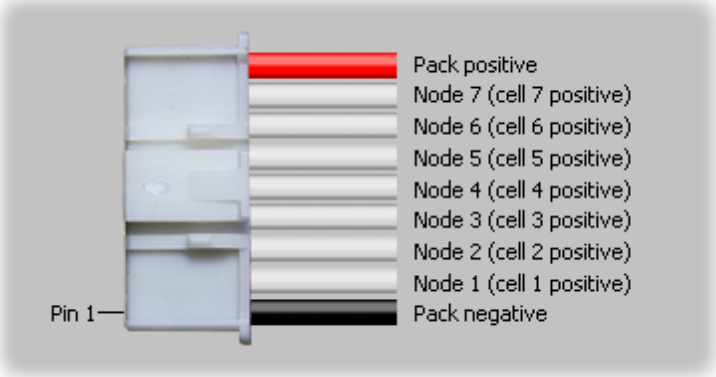
The "LiPo Performance Estimator" spreadsheet, which simplifies these calculations, can be downloaded from the www.revolectrix.com/downloads page.

3. **Evaluate results.**
   - Average current during flight gives you a rough idea whether system components—ESC, motor, connectors and wiring—are operating within their current ratings. Keep in mind that peak current during flight may greatly exceed the average current you calculated.

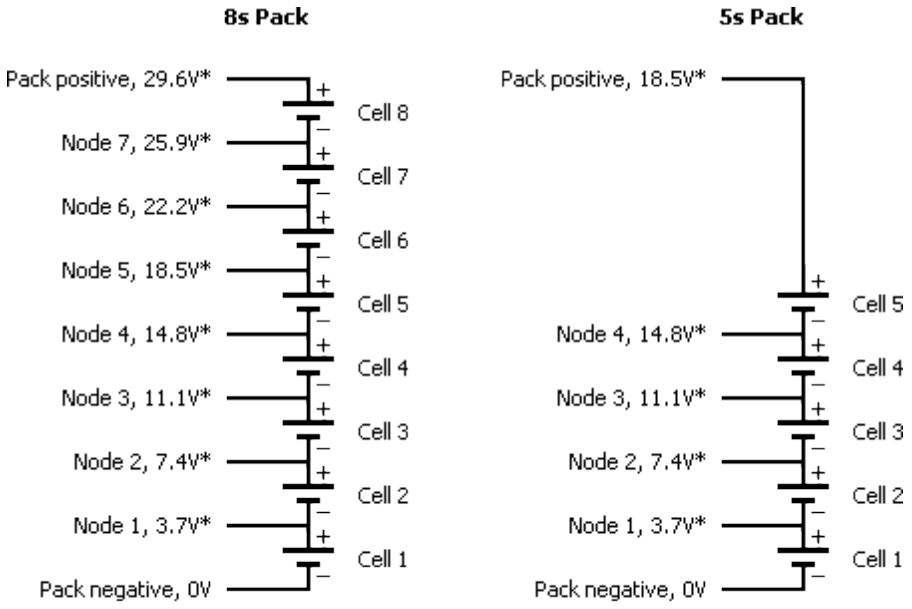
- Watts per pound is an approximate indicator of aircraft performance (other factors influencing performance include lift, drag and motor type). Here are some guidelines:
  - 25 to 30 watts per pound: level flight.
  - 40 to 50 watts per pound: take off from smooth surface, climb.
  - 50 to 75 watts per pound: take off from grass, sport aerobatics.
  - 75 to 125 watts per pound: pattern aerobatics.
  - Over 125 watts per pound: 3D.

Balance connector pinouts

For an 8s pack, the balance connector is wired like this:


Pack positive
Node 7 (cell 7 positive)
Node 6 (cell 6 positive)
Node 5 (cell 5 positive)
Node 4 (cell 4 positive)
Node 3 (cell 3 positive)
Node 2 (cell 2 positive)
Node 1 (cell 1 positive)
Pack negative
Pin 1

Pack positive and pack negative are always connected to the pack. Pack positive connects to the most positive cell's + side. Pack negative connects to the most negative cell's – side. If the pack has fewer than 8 cells, the higher nodes are not connected. Two pack wiring examples are shown below.



*Nominal voltage with respect to pack negative.

Open architecture presets

PowerLab 8 can be described as being "preset driven." All major aspects of its operation are defined as parameters at the preset level. The fact that you (for the most part) can set these parameters introduces the concept of "open architecture presets."

As an example of how preset parameters affect the charging process, each Auto mode preset includes a Fuel Table unique to a specific battery chemistry. When you select a User Preset for the REVO Red brand, for example, you are also selecting a Fuel Table tailored for that brand. The PowerLab 8 uses the Fuel Table to adjust current to maintain the specified C charge rate. Given a brand-specific Fuel Table, the Fuel Level display and Auto charge modes are highly accurate.

When preparing to charge a pack, the first step is to find the appropriate User Preset. If one doesn't exist, you might be able to create a User Preset from the closest Library Preset. Or you might select a User Preset from the library available in the Charge Control Software (which enables you to load, select, backup and share presets). You can even create a new, custom Fuel Table for any Li chemistry using the Fuel Table Wizard.

FMA technicians will continually update the presets library, which is included each time you update the Charge Control Software. This library will be supported far into the future as new battery brands and chemistries are introduced.

LiPo factory presets

LiPo Generic Accurate Charge

Basic LiPo preset can be used for any LiPo battery. Fuel Table is optimized for generic LiPo batteries from C discharge ratings up to 20C. Selectable charge rates include 1C, 2C, 3C AUTO or 10 mA to 10.0A manual. Optimization is for the most accurate charging with termination settings of C/20 and max of 30 min timeout for C.V. mode. This preset requires that every cell in the battery is charged to exactly 100%. If using high C rate discharge batteries (25C and higher), Fuel Gauge readout may not be accurate and AUTO charge rate may be higher or lower than expected. Default charge rate setting is 1C AUTO. Max Auto Amps parameter is default to 6A for this preset which means that unless you alter it, this preset will not exceed 6A max charge rate during AUTO charge. Other defaults: discharge rate setting is 2A, discharge voltage 3.3V/cell.

LiPo Generic Faster Charge

Basic LiPo preset can be used for any LiPo battery. Fuel Table is optimized for generic LiPo batteries from C discharge ratings up to 20C. Selectable charge rates include 1C, 2C, 3C AUTO or 10mA to 10.0A manual. Optimization is for faster charging with termination settings of C/10 and max of 15 min timeout for C.V. mode. This preset does not require that every cell in the battery is charged to exactly 100%. If using high C rate discharge batteries (25C and higher), Fuel Gauge readout may not be accurate and AUTO charge rate may be higher or lower than expected. Default charge rate setting is 2C AUTO. Max Auto Amps parameter is default to 6A for this preset which means that unless you alter it, this preset will not exceed 6A max charge rate during AUTO charge. Other defaults: discharge rate setting is 2A, discharge voltage 3.3V/cell.

LiPo Generic High Power

High Power LiPo preset can be used for any LiPo battery, but optimized for medium to high capacity packs. Also good for balance charging multiple LiPo packs in parallel. Fuel Table is optimized for generic LiPo batteries from C discharge ratings up to 20C. Selectable charge rates include 1C, 2C, 3C AUTO or 10 mA to 40A manual. Optimization is for faster charging with termination settings of C/10 and max of 15 min timeout for C.V. mode. This preset does not require that every cell in the battery is charged to exactly 100%. If using high C rate discharge batteries (25C and higher), Fuel Gauge readout may not be accurate and AUTO charge rate may be higher or lower than expected. Default charge rate setting is 10A Manual. Unless you create a custom preset and generate a custom fuel table, we recommend using Manual charge rate settings when charging using High Power presets. Max Auto Amps parameter is default to 10A for this preset which means that unless you alter it, this preset will not exceed 10A max charge rate during AUTO charge. Other defaults: discharge rate setting is 4A, discharge voltage 3.3V/cell.

LiPo Generic Long Life (4.1V)

Basic LiPo preset copied from Preset 1 above but with end-charge voltage reduced to 4.1V. All other parameters are the same. Use this preset if you wish to have the longest life from your LiPo batteries, but be aware, your flight times will be reduced slightly.

Fuel Table is optimized for generic LiPo batteries from C discharge ratings up to 20C, but table is revised to correlate to lower end charge voltage.

LiPo Generic Small Balanced

Special LiPo preset designed for charging small batteries but still using balance connector. This preset is recommended for battery sizes as small as 10 mAh and up to 500 mAh. Preset requires manual charge rate settings of between 10 and 500 mA in 5 mA increments by default. Optimization is for the most accurate charging with termination settings of C/20 and max of 30 min timeout for C.V. mode. This preset requires that every cell in the battery is charged to exactly 100%. If using high C rate discharge batteries (25C and higher), Fuel Gauge readout may not be accurate. Default charge rate setting is 350 mA. Other defaults: discharge rate setting is 500 mA, discharge voltage 3.3V/cell.

LiPo 1s/2s Small Non Balanced

Special LiPo preset designed for charging small Park Flier type batteries that are not equipped with balance connectors. Be cautious when charging any LiPo battery non-balanced. PowerLab 8 is not capable of detecting imbalance between cells. Never charge unattended using this preset. This preset is recommended for battery sizes as small as 10 mAh and up to 2000 mAh. Preset requires manual charge rate settings of between 10 and 2A in 5 mA increments by default. Fuel Table is optimized for generic LiPo batteries from C discharge ratings up to 20C. Optimization is for faster charging with termination settings of C/10 and max of 15 min timeout for C.V. mode. This preset does not require that every cell in the battery is charged to exactly 100%. If using high C rate discharge batteries (25C and higher), Fuel Gauge readout may not be accurate. Default charge rate setting is 350 mA. Other defaults: discharge rate setting is 500 mA, discharge voltage 3.3V/cell.

LiPo All Brands Storage Charge

Special LiPo preset (any capacity) designed to storage charge or discharge a battery up or down to 3.86V per cell. PL8 will automatically determine whether a charge or discharge process is required. This preset will balance charge to storage level, but terminates discharge on the lowest cell in the pack. Upon discharge termination, PL8 does incorporate CC/CV discharge algorithms for precise terminating voltage. Manual charge rate setting is required when using this preset and ranges from 10 mA to 10A. Charge and discharge termination voltage can be independently adjusted to further assure termination accuracy. Fuel Table is optimized for generic LiPo batteries from C discharge ratings up to 20C. Optimization is for super-faster charging with termination settings of C/5 and max of 15 min timeout for C.V. mode. This preset does not require that every cell in the battery is charged to exactly 100%. If using high C rate discharge batteries (25C and higher), Fuel Gauge readout may not be accurate. Default charge rate setting is 2A. Other defaults: discharge rate setting is 10A, charge voltage 3.86V/cell, discharge voltage 3.83V/cell.

A123 factory presets

A123 2300 mAh Accurate Charge

Optimized for balance charging A123, 2300 mAh battery packs (requires balance wires on the pack). Fuel Table is optimized for this specific battery type and capacity. Selectable charge rates include 1C, 2C, 3C, 4C, 5C AUTO or 10 mA to 10A manual. Optimization is for the most accurate charging with termination settings of C/20 and max of 30 min timeout for C.V. mode. This preset requires that every cell in the battery is charged to exactly 100%. This preset may also be used for LiFePO4 type batteries which have similar charge characteristics. When using LiFePO4 batteries, Fuel Gauge readout may not be accurate and AUTO charge rate may be higher or lower than expected. Default charge rate setting is 4.6A Manual. Max Auto Amps parameter is default to 10A for this preset which means that this preset will not exceed 10A max charge rate during AUTO charge. Other defaults: discharge rate setting is 2.25A, discharge voltage 2.8V/cell.

A123 2300 mAh Faster Charge

Optimized for balance charging A123, 2300 mAh battery packs (requires balance wires on the pack). Fuel Table is optimized for this specific battery type and capacity. Selectable charge rates include 1C, 2C, 3C, 4C, 5C AUTO or 10 mA to 10A manual. Optimization is for faster charging with termination settings of C/20 and max of 15 min timeout for C.V. mode. This preset does not require that every cell in the battery is charged to exactly 100%. This preset may also be used for LiFePO4 type batteries which have similar charge characteristics. When using LiFePO4 batteries, Fuel Gauge readout may not be accurate and AUTO charge rate may be higher or lower than expected. Default charge rate setting is 4.6A Manual. Max Auto Amps parameter is default to 10A for this preset which means that this preset will not exceed 10A max charge rate during AUTO charge. Other defaults: discharge rate setting is 2.25A, discharge voltage 2.8V/cell.

A123 2300 mAh High Power

High Power A123 Preset optimized for Fast balance charging A123, 2300 mAh battery packs (requires balance wires on the pack). Also good for balance charging multiple A123 packs in parallel. Preset requires manual charge rate settings of between 10 mA and 30 mA. Fuel Table is optimized for this specific battery type and capacity. Optimization is for faster charging with termination settings of C/20 and max of 15 min timeout for C.V. mode. This preset does not require that every cell in the battery is charged to exactly 100%. This preset may also be used for LiFePO4 type batteries which have similar charge characteristics. When using LiFePO4 batteries, Fuel Gauge readout may not be accurate. Default charge rate setting is 10A Manual. Other defaults: discharge rate setting is 10A, discharge voltage 2.8V/cell.

A123 2300 mAh Non Bal. 1-5s

Optimized for non-balance charging A123, 2300 mAh battery packs (balance wires not required on the pack). Fuel Table is optimized for this specific battery type and capacity. Selectable charge rates include 1C AUTO or 10 mA to 20A manual. Optimization is for

faster charging with termination settings of C/10 and max of 15 min timeout for C.V. mode. This preset is not capable of charging every cell in the battery to exactly 100% because it does not have access to individual cell voltages. Imbalance will be present at the end of charge; however, A123 cells are not as sensitive to this problem. Nevertheless, charging A123s using the balanced charge preset(s) is recommended whenever possible. This preset may also be used for LiFePO4 type batteries which have similar charge characteristics. When using LiFePO4 batteries, Fuel Gauge readout may not be accurate and AUTO charge rate may be higher or lower than expected. Max Auto Amps parameter is default to 5A for this preset which means that unless you alter it, this preset will not exceed 5A max charge rate during AUTO charge. Default charge rate setting is 4.6A manual. Because this preset is not restricted by the balance connector, it can handle 1-5 cells of this battery type only. Other defaults: discharge rate setting is 2.25A, discharge voltage 2.8V/cell.

A123 2300 mAh Non Bal 8s Fixed

Optimized for non-balance charging A123, 2300 mAh battery packs (balance wires not required on the pack). Fuel Table is optimized for this specific battery type and capacity. Selectable charge rates include 1C AUTO or 10 mA to 20A manual. Optimization is for faster charging with termination settings of C/10 and max of 15 min timeout for C.V. mode. This preset is not capable of charging every cell in the battery to exactly 100% because it does not have access to individual cell voltages. Imbalance will be present at the end of charge; however, A123 cells are not as sensitive to this problem. Nevertheless, charging A123s using the balanced charge preset(s) is recommended whenever possible. This preset may also be used for LiFePO4 type batteries which have similar charge characteristics. When using LiFePO4 batteries, Fuel Gauge readout may not be accurate and AUTO charge rate may be higher or lower than expected. Max Auto Amps parameter is default to 5A for this preset which means that unless you alter it, this preset will not exceed 5A max charge rate during AUTO charge. Default charge rate setting is 4.6A manual. This is an example of a fixed-count preset. It will not autodetect the cell count of a battery pack. It is designed specifically for an 8 cell A123 pack. If your A123 pack has a different number of cells, copy this preset to an EMPTY preset slot, rename it, and alter the "Cells" parameter found in the "Detection" tab of the CCS. Otherwise, you may find an A123, fixed cell preset already designed for your battery in the Preset Library of the PowerLab 8 or within the CCS. Other defaults: discharge rate setting is 2.25A, discharge voltage 2.8V/cell.

A123 1100 mAh Accurate Charge

Optimized for balance charging A123, 1100 mAh battery packs (requires balance wires on the pack). Fuel Table is optimized for this specific battery type and capacity. Selectable charge rates include 1C, 2C, 3C, 4C, 5C AUTO or 10 mA to 6A manual. Optimization is for the most accurate charging with termination settings of C/20 and max of 30 min timeout for C.V. mode. This preset requires that every cell in the battery is charged to exactly 100%. This preset may also be used for LiFePO4 type batteries which have similar charge characteristics. When using LiFePO4 batteries, Fuel Gauge readout may not be accurate and AUTO charge rate may be higher or lower than expected. Default charge rate setting is 2.2A manual. Max Auto Amps parameter is default to 6A for this preset which means that this preset will not exceed 6A max charge rate during AUTO charge. Other defaults: discharge rate setting is 1A, discharge voltage 2.8V/cell.

A123 1100 mAh Faster Charge

Optimized for balance charging A123, 1100 mAh battery packs (requires balance wires on the pack). Fuel Table is optimized for this specific battery type and capacity. Selectable charge rates include 1C, 2C, 3C, 4C, 5C AUTO or 10 mA to 6A manual. Optimization is for faster charging with termination settings of C/20 and max of 15 min timeout for C.V. mode. This preset does not require that every cell in the battery is charged to exactly 100%. This preset may also be used for LiFePO4 type batteries which have similar charge characteristics. When using LiFePO4 batteries, Fuel Gauge readout may not be accurate and AUTO charge rate may be higher or lower than expected. Default charge rate setting is 3.3A Manual. Max Auto Amps parameter is default to 6A for this preset which means that this preset will not exceed 6A max charge rate during AUTO charge. Other defaults: discharge rate setting is 1A, discharge voltage 2.8V/cell.

A123 1100 mAh Non Bal. 1-5s

Optimized for non-balance charging A123, 1100 mAh battery packs (balance wires not required on the pack). Fuel Table is optimized for this specific battery type and capacity. Selectable charge rates include 1C AUTO or 10 mA to 10A manual. Optimization is for faster charging with termination settings of C/10 and max of 15 min timeout for C.V. mode. This preset is not capable of charging every cell in the battery to exactly 100% because it does not have access to individual cell voltages. Imbalance will be present at the end of charge; however, A123 cells are not as sensitive to this problem. Nevertheless, charging A123s using the balanced charge preset(s) is recommended whenever possible. This preset may also be used for LiFePO4 type batteries which have similar charge characteristics. When using LiFePO4 batteries, Fuel Gauge readout may not be accurate and AUTO charge rate may be higher or lower than expected. Max Auto Amps parameter is default to 3A for this preset which means that unless you alter it, this preset will not exceed 3A max charge rate during AUTO charge. Default charge rate setting is 2.2A manual. Because this preset is not restricted by the balance connector, it can handle 1-5 cells of this battery type only. Other defaults: discharge rate setting is 1A, discharge voltage 2.8V/cell.

A123 1100 mAh Non Bal 8s Fixed

Optimized for non-balance charging A123, 1100 mAh battery packs (balance wires not required on the pack). Fuel Table is optimized for this specific battery type and capacity. Selectable charge rates include 1C AUTO or 10 mA to 10A manual. Optimization is for faster charging with termination settings of C/10 and max of 15 min timeout for C.V. mode. This preset is not capable of charging every cell in the battery to exactly 100% because it does not have access to individual cell voltages. Imbalance will be present at the end of charge; however, A123 cells are not as sensitive to this problem. Nevertheless, charging A123s using the balanced charge preset(s) is recommended whenever possible. This preset may also be used for LiFePO4 type batteries which have similar charge characteristics. When using LiFePO4 batteries, Fuel Gauge readout may not be accurate and AUTO charge rate may be higher or lower than expected. Max Auto Amps parameter is default to 3A for this preset which means that unless you alter it, this preset will not exceed 3A max charge rate during AUTO charge. Default charge rate setting is 2.2A manual. This is an example of a fixed-count preset. It will not autodetect the cell count of a battery pack. It is designed specifically for an 8 cell A123 pack. If your A123 pack has a different number of cells, copy this preset to an EMPTY

preset slot, rename it, and alter the "Cells" parameter found in the "Detection" tab of the CCS. Otherwise, you may find an A123, fixed cell preset already designed for your battery in the Preset Library of the PowerLab 8 or within the CCS. Other defaults: discharge rate setting is 1A, discharge voltage 2.8V/cell.

A123 All Cpcty Storage Charge

Special A123 preset (any capacity) designed to storage charge or discharge a balanced battery up or down to 3.335V per cell. PowerLab 8 will automatically determine whether a charge or discharge process is required. This preset will balance charge to storage level, but terminates discharge on the lowest cell in the pack. Upon discharge termination, PowerLab 8 does incorporate CC/CV discharge algorithms for precise terminating voltage. Manual charge rate setting is required when using this preset and ranges from 10 mA to 10A. Charge and discharge termination voltage can be independently adjusted to further assure termination accuracy. Fuel Table is optimized for A123 2300 mAh batteries. Optimization is for faster charging with termination settings of C/20 and max of 15 min timeout for C.V. mode. This preset does not require that every cell in the battery is charged to exactly 100%. If using A123 1100 mAh or LiFePO4 batteries, Fuel Gauge readout may not be accurate. Default charge rate setting is 2.2A. Other defaults: discharge rate setting is10A, charge voltage 3.335V/cell, discharge voltage 3.32V/cell.

A123 Store Non Bal. 1-5s

Special A123 preset (any capacity) designed to storage charge or discharge a non-balanced battery up or down to 3.335V per cell. PowerLab 8 will automatically determine whether a charge or discharge process is required. This preset will charge to storage level and terminates discharge on the lowest cell in the pack. Upon discharge termination, PowerLab 8 does incorporate CC/CV discharge algorithms for precise terminating voltage. Manual charge rate setting is required when using this preset and ranges from 10 mA to 10A. Charge and discharge termination voltage can be independently adjusted to further assure termination accuracy. Fuel Table is optimized for A123 2300 mAh batteries. Optimization is for faster charging with termination settings of C/10 and max of 15 min timeout for C.V. mode. This preset is not capable of charging every cell in the battery to exactly 100% because it does not have access to individual cell voltages. Imbalance will be present at the end of charge; however, A123 cells are not as sensitive to this problem. Nevertheless, charging A123s using the balanced charge preset(s) is recommended whenever possible. If using A123 1100 mAh or LiFePO4 batteries, Fuel Gauge readout may not be accurate. Default charge rate setting is 2.2A. Other defaults: discharge rate setting is 10A, charge voltage 3.335V/cell, discharge voltage 3.32V/cell.

A123 Store Non Bal 8s Fixed

Special A123 preset (any capacity) designed to storage charge or discharge a non-balanced battery up or down to 3.335V per cell. PowerLab 8 will automatically determine whether a charge or discharge process is required. This preset charge to storage level and terminates discharge on the lowest cell in the pack. Upon discharge termination, PowerLab 8 does incorporate CC/CV discharge algorithms for precise terminating voltage. Manual charge rate setting is required when using this preset and ranges from 10 mA to 10A. Charge and discharge termination voltage can be independently adjusted to further assure termination accuracy. Fuel Table is optimized for A123 2300 mAh batteries. Optimization is for faster charging with termination settings of C/10 and max of

15 min timeout for C.V. mode. This preset is not capable of charging every cell in the battery to exactly 100% because it does not have access to individual cell voltages. Imbalance will be present at the end of charge; however, A123 cells are not as sensitive to this problem. Nevertheless, charging A123s using the balanced charge preset(s) is recommended whenever possible. If using A123 1100 mAh or LiFePO4 batteries, Fuel Gauge readout may not be accurate. Default charge rate setting is 2.2A. This is an example of a fixed-count preset. It will not auto-detect the cell count of a battery pack. It is designed specifically for an 8 cell A123 pack. If your A123 pack has a different number of cells, copy this preset to an EMPTY preset slot, rename it, and alter the "Cells" parameter found in the "Detection" tab of the CCS. Otherwise, you may find an A123, fixed cell preset already designed for your battery in the Preset Library of the PowerLab 8 or within the CCS. Other defaults: discharge rate setting is 10A, charge voltage 3.335V/cell, discharge voltage 3.32V/cell.

NiMH, NiCd and Lead Acid factory presets

NiCd Fast Charge with Trickle

Basic NiCd Fast Charge with Delta Peak Cutoff and Trickle Charge. Requires manual charge rate setting of between 10 mA and 20A, with default value of 1A. Can charge from 1 to 21 cell packs. Fallback default setting is 8mV. Trickle charge rate is 1/20C of the charge rate setting. Charge will timeout in 4 hrs if peak is not reached. Trickle charge timeout is set for 1 Day. This preset is for constant current charging applications only. Do not use this for Li, Pb, or other chemistries. Other defaults: discharge rate setting is 1A, discharge voltage 1V/cell.

NiMH Fast Charge with Trickle

Basic NiMH Fast Charge with Delta Peak Cutoff and Trickle Charge. Requires manual charge rate setting of between 10 mA and 20A, with default value of 1A. Can charge from 1 to 21 cell packs. Fallback default setting is 5mV. Trickle charge rate is 1/20C of the charge rate setting. Charge will timeout in 4 hrs if peak is not reached. Trickle charge timeout is set for 1 Day. This preset is for constant current charging applications only. Do not use this for Li, Pb, or other chemistries. Other defaults: discharge rate setting is 1A, discharge voltage 1V/cell.

NiCd/NiMH 24 Hr Trickle Charge

Basic NiCd or NiMH 24 Hour Trickle Charge preset. Requires manual charge rate setting of between 10 mA and 500 mA with default value of 100 mA. Can charge from 1 to 21 cell packs. Trickle charge timeout is set for 1 Day.

Lead 12V SLA or Gel Cell

Basic Pb (Lead) preset for charging 12V SLA or Gel Cell batteries. Requires manual charge rate setting of between 10 mA and 40A, with default value of 7A. Charges 12V battery only. If you require a 24V charge, this preset is available in the library and can be copied into the user bank (see manual for instructions). Charge will timeout in 16 hours even if end charge voltage setting of 2.33V/cell (default) is not achieved.

Troubleshooting

Operating errors appear as safety codes in the display. If possible, correct the error. If errors continue, contact FMA Customer Service.

Code	Cause
1	Increase Supply
2	Supply <10 Volts
3	Supply >16 Volts
4	Supply Unstable
5	Prset not for 4S
6	Bad Preset Versn
7	Reduce NiCd Amps
8	Series Chrgrs?
9	P. Library Empty
10	Low Voltage Cell
11	Preset is Hidden
12	Reverse Polarity
13	Preset is Empty
14	MODE not Pressed
15	System Softstart
16	Preset is Locked
17	Ch1 No Add Up
18	Max Cells Error
19	No Pack
20	Bad Cell Count
21	Bad P. Ram Check
22	Cells Exceeded
23	Un-Bal. Only
24	Charge Timeout
25	Cell Cnt Changed
26	NiCd Detected
27	Cells no Correct
28	Cell OverVoltage
78	High Voltage When Off
79	CH1 Cells Out of Range
88	Checkpack1 Cell V Out of Range

Code	Cause
90	Unknown Screen Number
92	Mux Number Error
93	Calibration Checksum Bad
94	Bad EEPROM Write
95	Bypass Overvolt
96	PWM Ratio Too High
97	Bad FET Supply Voltage
98	Charger Overcurrent
99	Bad Mode Number
100	Temp out of Rnge
105	Preset not validated
106	Preset number out of range
107	Charge Timeout out of range
108	Preset loaded while charging
109	Charge Termination Unknown
111	Preset Cell OverVolts too High
112	Options Checksum is BAD
113	Charge PWM not regulating
114	Bad Preset Flash Checksum while running
115	Bad Preset Flash Checksum on Start
116	Bad Preset Ram Checksum on Start
117	Bad Segment Checksum on Start
118	Bad Segment Checksum while running
120	Lithium Cell Count not Verified
121	Shunt FET off while CHG/DSCH
122	Unknown Chemistry
123	No Charge Screens to Show
124	Bad Run Screen Number
125	Cell Count is Zero
126	Discharge Mode not set to Balancer
127	Discharge Mode Timeout
128	Peek Detect set past 15 min
129	NiCd Chem must use FallBack
130	Lith Chem must not use FallBack
131	Oscillator Calibration Erased

REVOLECTRIX Limited Warranty

REVOLECTRIX warrants PowerLab 8 to be free of manufacturing defects for the term of one year from the date of purchase. Should any defects covered by this warranty occur, the product shall be repaired or replaced with a unit of equal performance by REVOLECTRIX or an authorized REVOLECTRIX service station.

Limits and exclusions

This warranty may be enforced only by the original purchaser, who uses this product in its original condition as purchased, in strict accordance with the product's instructions. Units returned for warranty service to a REVOLECTRIX service center will be accepted for service when shipped postpaid, with a copy of the original sales receipt or warranty registration form, to the service station designated by REVOLECTRIX.

This warranty does not apply to:

- Consequential or incidental losses resulting from the use of this product.
- Damage resulting from accident, misuse, abuse, neglect, electrical surges, reversed polarity on connectors, lightning or other acts of God.
- Damage from failure to follow instructions supplied with the product.
- Damage occurring during shipment of the product either to the customer or from the customer for service (claims must be presented to the carrier).
- Damage resulting from repair, adjustment, or any alteration of the product by anyone other than an authorized REVOLECTRIX technician.
- Installation or removal charges, or damage caused by improper installation or removal.

Call (301) 668-4280 for more information about service and warranty repairs.

Support

For customers in North and South America who purchased directly from the REV-OLECTRIX or FMA Direct website, support is provided by FMA Direct:

E-mail Sales: sales@revolectrix.com
E-mail Tech Support - Electronics and RF: support@revolectrix.com

Phone Technical Support: 301-668-4280
Fax: 301-668-7619

For customers in North and South America who purchased from other distributors, please contact the distributor for support.

For customers outside North and South America, please contact the manufacturer, Leo Industries in Singapore.

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